UNIVERSITY OF ALBERTA

HIGH SCHOOL STUDENTS' EXPERIENCES TAKING A CALCULUS COURSE THROUGH VIDEO CONFERENCING: A CASE STUDY

BY

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ABSTRACT

This case study examines the experiences of six students registered in a senior high school calculus course delivered by videoconference. The participants resided in a small west-central Alberta community and formed the remote site in a point-to-point videoconference course. The data for this study were collected from a series of on-site visitations over the duration of the five-month course as well as videoconference observations, semi-structured student interviews conducted during each site visitation, and email correspondence with the participants.

The focus of this study was to identify the issues and concerns expressed by the students and to monitor the changes in these perceptions over the duration of the course. Students were also asked to identify successful learning strategies employed in this environment. The findings are presented in a chronological account of the course. This is followed by a description of the changes experienced by the individual students and an account of the common themes and patterns that emerged from their experiences.

Student comments related to the technology, pedagogy, personal and social characteristics of the participants, and the educational context were examined. The study concludes with the identification of further research questions that emerge from the findings.

TABLE OF CONTENTS

Chapter 1 Introduction	1
Arriving at the Question	3
Purpose of the Study	6
Research Question	7
Significance of the Study	9
Overview of the Study	10
Chapter 2 Review of the Literature	13
Introduction	13
Expectations of Children and Adults in Learning	14
Transactional Distance	16
Social Presence and Immediacy	22
Presence, Culture, and Place	35
Conclusion	37
Chapter 3 Methodology	39
Purpose of the Study	39
Research Approach	40
Participant Selection	43
Data Collection	45
Data Analysis	50
Role of the Researcher	55
Limitations and Delimitations	57
Assumptions	58
Conclusion	58
Chapter 4 Results of the Study	59
Describing the Setting	59
Remote Site Participants	64
Bob	64
Cindy	65
Mark	66
Mary	66
Gary	67
John	68
Observations and Student Perceptions	69

Events of January 28, 2004 69
Post-Class Reflections 73
Events of February 4, 2004 74
Events of February 19, 2004 75
Initial Interview Results 80
An Interesting Change in Perception! 81
Post-Interview Reflection 92
Events of March 22, 2004 94
Gary 96
Mary 99
Comments from Remaining Students 101
Post-Interview Reflection 108
Events of May 4, 2004 110
Interview Comments 112
Post-Interview Reflection 124
Events of June 10, 2004 125
Interview Comments 126
Summary 129

Chapter 5 Identifying Changes and Patterns 132

Student Accounts 134
Mary 134
Gary 140
John 146
Bob 150
Cindy 159
Mark 167
Patterns or Themes 172
The Technology 174
The Pedagogical Style 177
Personal Characteristics/Social Dynamics 185
The Social and Cultural Context 192
Conclusions and Recommendations for Further Study 198

References 210

LIST OF FIGURES

Figure 1 – Development Stages of an Observer 45

Figure 2 – Site Location Diagram 61

Figure 3 – Remote Site Room Layout 63

Figure 4 – Mark's Level of Satisfaction Graph 119

Figure 5 – Cindy's Level of Satisfaction Graph 121

Figure 6 – Bob's Level of Satisfaction Graph 123

Figure 7 – Student Completion Graph 131

Chapter One

Introduction

Methods and tools used in teaching and learning are continuously changing. In oral cultures one can visualize the storyteller, surrounded by a small group of friends, filling their minds with familiar contexts but also with expectations of new revelations. Knowing glances are exchanged about the group as they share in the experience - be it a humorous anecdote, a parable, or a re-telling of a story that forms a part of their cultural heritage. Discussions that follow clarify meaning and assist in remembering the significance of the event. Individual meaning is created in the mind of the listener but at the same time the individual feels as though s/he is a part of a larger story. The cycle is repeated from one generation to the next.

A child sits on a parent's lap and hears words read from the page of a book. Visions of similar stories appear in the child's mind and the comforting presence of the parent assures the child that only good things are about to happen. The author of the story is distant and unknown but the story comes to life through the voice of the parent. The pictures on the storybook pages become real and are animated by the imagination of the child. The dialogue between parent and child makes connections with previous stories and with real

life experiences resulting in the story taking on a unique meaning in the minds of both the child and the reader. The child soon learns that stories reside in printed texts and can be told and retold at any time or place that is convenient. The story unfolds in the mind of the reader at a pace determined by the individual, with sidebar stories popping to mind triggered by words and phrases connected to previous experiences. Every reading of the story is unique and every reading of the story is a lived experience. The cycle is repeated from one generation to the next.

A child enters a classroom and sits down in front of a camera and monitor. S/he is the only one in the room. The videoconference session begins with the instructor taking attendance and exchanging pleasantries with the students at the main site and the remote sites. Questions are asked and answered. The story unfolds as scripted with dialogue that makes connections to previously learned material, new revelations are made, and promises are made of even bigger and better things to follow in tomorrow's class. But, where are the knowing glances? Is there a feeling of shared experience? Is the presence of peers and instructor felt or merely observed? Where is the informal banter that exists after the closing bell? Does all of this matter? Do we want this cycle to be repeated from one generation to the next?

Arriving at the Question

Over the past twenty-five years I have worked in the area of technology use in education. This journey has taken me from the early introduction of computers into the school system, through production of educational television, development of computer-assisted instruction, writing of eight computer programming curriculum modules for the Career and Technology Studies program, illustrative exemplars for the Information and Communications Technology program, to piloting video conference delivery of courses at the high school level. Through this time period, the questions asked at the end of the previous paragraph have become increasingly more important in my understanding of the student's learning experience. My focus has changed from 'how to make the technology work' to 'how does learning with technology take place'. This change in focus has forced me to look beyond the technological context of learning to examine social and cultural factors as well as the nature of technologically imposed change. The ability to adapt existing skills, strategies, and attitudes, primarily developed in face-to-face instruction, varies from individual to individual and is a determining factor in academic success. Observations of the use of various technologies in the educational setting and observations of the same technologies in the hands of different instructors and students has led me to believe that knowledge development is a complex interplay between a number of factors, not the least of these being the social

relationship between the participants and the cultural setting in which learning takes place.

The introduction of new, technologically mediated learning environments challenges existing relationships between participants. Expanding the boundaries of the classroom to include students from a variety of different locations creates an awareness of differing school cultures and attitudes towards instruction. At the same time, learners are asked to establish new social relationships, differing from those that have supported their learning in the past. What learning tools, skills, and processes survive the migration to the new setting and which must be adapted or replaced? How does the change process occur and what factors aid or hinder this change process?

The educational context of any study is a mix of social, political, and economic factors. The environment in which this study was conducted is no different. A number of geographical and economic factors have shaped the educational system we have today and dictate the direction it will take in the future. The ongoing decline of rural populations in most of Canada has created an urgency to examine the ways in which we provide instruction to an increasingly dispersed population spread over a large geographic area. In spite of dwindling rural population, community pressure continues to be exerted on existing small schools and their school boards to maintain a viable educational

program for their students. In many cases the maintenance of the school in a given area is vital to the preservation of the community itself. Reduction in school populations has led to teachers being assigned a wide range of courses, split classes, and increased pressure on school staffs to do more with fewer resources. The resulting job dissatisfaction, paired with an increasing shortage of teachers in specific subject areas, has created significant gaps in the instructional programs offered by some small schools. These program deficiencies have traditionally been addressed by print based correspondence courses. The decision by the Alberta government to provide educational access to the *Supernet* communications network has presented an opportunity to use videoconference technology to address the problem of providing educational opportunities in rural areas comparable to those available in urban areas.

In addition to being a teacher, I am also a learner. Having taken a number of graduate courses through synchronous and asynchronous forms as well as acting as a facilitator in a variety of technologically-mediated learning environments has given me not only the opportunity to observe others functioning in these settings but also to experience it personally. Reflecting on my experience using technology in education, the questions that come to mind concern the appropriateness of the use of this technology in a secondary school setting. The push, by Alberta Education and other educational bodies, to incorporate technology into both the content and delivery of education has

accelerated over the years. Some of these advances have been readily accepted and have proven themselves to be valuable while others have been tried and abandoned. This research project examined not only how the videoconference setting shapes the 'hand' or the mind of the user, but how this shaping takes place, the issues that arise during this shaping process, and the changes it forces on the participants. How do the videoconference technology and the resulting social and cultural changes influence the complex mix that forms the learning experience? Students, especially secondary school students, are rarely given a voice in designing instructional changes. They are always subjects but rarely authors of the change process. This research examined the experiences of a group of students taking a course in a videoconference setting. Where better to look for answers to the questions associated with mediated instruction than to those directly involved in it.

Purpose of the Study

The main purpose of this study was to gain insights into the experiences of students taking a course by videoconference. Prompted by a concern for the well being of the students and the desire to make any learning experience as enjoyable and rewarding as possible, this study focused on student perceptions of the learning experience, the tools and skills they bring to the setting, the changes experienced during the course, and the social component of the learning experience. Student perceptions of the learning experience were as

varied as the students who entered the course and were constructed from unique personal histories. The new, mediated experience does not stand in isolation but is influenced by past experiences and will shape the way in which future learning experiences are approached. While an external observer may question the validity of student perceptions, we must keep in mind the fact that these views of reality are very 'real' in the minds of the students. These individual perceptions are what govern students' reactions, the learning that takes place, their satisfaction level in the course, and their persistence in staying enrolled in the course. While these views of the learning experience may be a complex mix of media characteristics, the nature of the instruction, and the participant histories, the priorities and the direction of this study were provided by the concerns expressed by the students. Through examination of, and reflection on, these experiences both the students involved and the researcher have gained a better understanding of what it means to learn in the videoconference environment.

Research Question

The research question for this study is: What are the experiences of rural high school students taking a course delivered by videoconference?

This research into the students' experiences was guided by the following related questions.

1. What learning strategies (tools and processes) do learners bring to the videoconference setting?

2. How does the videoconference experience fit within the rest of the student's educational experiences?

3. In the students' perception of the learning experience, is being visible the same as being present?

4. How does technologically mediated delivery influence the learning experience?

5. What issues, concerns, patterns, or themes emerge from the videoconference learning experience?

6. Does the physical and social context of the videoconference experience influence the learning strategies used? If so, how? If not, why?

7. How do students' perceptions of the videoconference experience change over the duration of the course?

8. Have the students' learning strategies adapted over the duration of the course to accommodate the changes in the learning environment brought about by video conferencing?

Significance of the Study

From a professional perspective, this case study provided insights into the experiences and learning strategies of a single class of students taking a course by videoconference. These insights help to develop our understanding of video mediated instruction, assist in the design of instruction for this medium, and may guide future practice in this emerging field. This study adds to the minuscule amount of literature related to the use of videoconference instruction in the secondary school setting. Through relating learner experiences, this study describes the paths taken by a group of students registered in a course delivered by videoconference. Along this journey, signposts have been erected to draw attention to issues and concerns that arose. These may forewarn those following a similar path and may also form the bases for further research.

From a personal perspective, as a videoconference coordinator in a public school system, this study has provided me with, not only student issues and concerns to share with prospective videoconference teachers, but also a reminder of how important it is to talk not just 'at' our students but also 'with' our students.

Overview of the Study

In this first chapter I describe my interest in student experiences in technologically mediated learning and briefly examine the social, political, and economic factors leading to its use. I present the research questions and highlight the contributions this study will make to the field of videoconference instruction at the secondary level.

Chapter Two highlights the absence of literature related to videoconference instruction at the secondary level. Literature related to post secondary and adult, professional use of videoconference is referenced with an eye to the differences between adults and children in the learning process. Distance learning literature related to transactional distance is reviewed, along with that related to the notion of presence in a mediated setting. Finally, literature dealing with the nature of classroom culture and place are reviewed with a view to their influence on the videoconference experience.

Chapter Three outlines the methodology used to collect and analyse the data. Through observations, interviews, and email discussions with the student involved in a videoconference delivered course, I gathered descriptions of the learning experience over the duration of a five-month semester. An interpretive stance is taken with the focus being placed on identifying changes in perception that occur over time as well as identifying common themes or patterns that emerge from this group of students.

In Chapter Four I present the data gathered from the students involved in the study. The students are introduced along with the technical, social, and cultural setting of the study. Four personal visits were made to observe the student in this class. Individual student interviews were conducted on each visit. These interview data are supplemented by observational data collected both on site and through videoconference observations as well as email correspondence with the students between site visits.

The final chapter presents my analysis of the data focusing on a number of issues raised by the students. I examine the findings in light of the literature pertaining to mediated instruction as well as that related to the change process and classroom culture. A summary of the study is provided along with suggested questions for further study. I complete the chapter with my personal reflections on the research experience and the places that it takes in my work as a teacher and videoconference coordinator.

Chapter Two

Review of the Literature

Introduction

For the purpose of this study the term 'videoconferencing' will be used to describe the real time interactive exchange of both voice and video for educational purposes. While a great deal has been written about videoconferencing in post secondary and professional settings very little has appeared with regard to its use in the K - 12 environment (Heath and Holznagel, 2002). Reduced cost of equipment and the ability to conduct videoconference sessions over existing Internet connections may be reasons why this technology is just now appearing in the K - 12 setting. The vast majority of the literature related to videoconference delivery of courses deals with the specific characteristics of the technology or with the area of instructional design. The primary focus has been on 'how to' deliver instruction in this format with very little attention paid to the topic of student satisfaction (Binar, 1993). There are even fewer published accounts concerned with the quality of the learning experience from the students' perspective. Most of the literature related to the use of videoconference technology in the K - 12 setting relates to short-term 'electronic field trips' that are incorporated into traditional face-to-face educational settings (Heath and Holznagel, 2002). With this in mind, the literature reviewed is that which is related to characteristics of video conference

delivery of courses that pertain to the quality of the learning experience of students involved in technologically mediated learning. Additional literature related to the difference between the expectations of adults and children in learning, as well as that related to student assessment of instructional programs will also be examined.

Expectations of Children and Adults in Learning

Adults and children usually do not enter the learning experience with the same background knowledge, expectations, or motivations. Collis (1996) states that:

> Adults, more so than students in K - 12 education, tend to be goal-oriented, are critical if courses do not meet their requirements, can often make their own selection as to which institution they attend and what courses they take, are more self-reliant, and expect more control in decision making about their work and study requirements. (p. 295)

While some secondary school students may challenge the veracity of her comments, these students' most recent learning environment has probably been a traditional face-to-face instructional setting in which learners rely heavily upon the instructor for setting the pace and delivering the instruction. This may suggest that the synchronous delivery of courses in a format other than the traditional face-to-face mode may be better received by secondary students than by adults. A recent project by the Alberta Distance Learning Centre (ADLC, 2002) designed to deliver a number of secondary school courses by live, synchronous audio-graphic delivery has met with success. Both

completion rates and academic achievement have surpassed levels attained in asynchronous delivery. Their web site claims that:

> The atmosphere is exciting and motivating with students experiencing tremendous success. Every ADLC synchronous course has demonstrated its value by significantly raising completion rates and student achievement levels.

In comparison to traditional print based distance-learning materials, the synchronous delivery mode has, in some courses, more than tripled the completion rate. An interesting side note is that in one secondary level mathematics course, the students organized an informal weekend gathering to meet their classmates. There was a need to be able to put faces to the voices they had been hearing during class. (personal conversation with E. Kupsch, ADLC, February 10, 2002). This may be an indicator of the importance of the social aspect of learning that is present in the traditional classroom setting but was missed in the mediated environment.

The relative success of the synchronous over the asynchronous mode of delivery speaks to the concept of self-reliance noted by Collis (1996). The debate over these two delivery methods has been ongoing, but is usually conducted from an adult learning perspective. McLoughlin and Oliver (1999), Bates (1995), and others have commented that in a synchronous learning environment the students are restricted to instruction delivered in a fixed time and place, characterized by a lack of time for reflection and the absence of a

text-based record of communication. While the lack of time for reflection and the lack of a text based record of the communication are characteristics that may be overcome by the design of the instruction, the fact that the instruction occurs at a fixed time and place may be viewed as a positive structuring element from a secondary school student's perspective. While reading the literature on videoconference delivery of adult education one must be continually aware of the difference in the need for control over when and where learning takes place. Differences between previous experiences and current contexts of adults and children may make what appears to be a detrimental characteristic to one age group a benefit to the other.

Transactional Distance

The delivery of instruction by videoconference changes the experience of geographic distance between the remote learner and the site of instruction. Through the mediation of technology, learners and the instructor are able to see and hear each other regardless of location. Moore (1993) does not view distance in geographic terms but in pedagogic terms. He has coined the term 'transactional distance' to describe the perceived psychological distance in the relationship that exists between learners and instructors who are separated by space and/or time. He suggests that transactional distance is a hindrance to leaning and must be overcome by dialogue. He goes so far as to state that this perceived psychological distance may exist even in traditional face-to-face

settings where communication is not mediated by technology. Chen (2001), on the other hand, argues that the presence of mediated communication may provide a safe buffer zone between the learner and the instructor that may reduce the tension and anxiety that some learners experience in a face-to-face setting. These conflicting, or at least ambivalent, statements in the literature related to transactional distance in technologically mediated adult distance learning raise the question of how this characteristic of distance learning is experienced by high school aged learners taking a course by video conference. A key aspect of instruction is to overcome or reduce this transactional distance through dialogue and interaction. Through the use of technology this interaction is possible but as Haughey (1995) suggests, the nature of this interaction is a socially constructed phenomenon that is influenced by the presence of the technology:

> In a classroom setting, student presence carries with it social responsibilities and may require participation. In a distance education setting, the same issues of control and participation are attempted through the language of student presence. In mediated communications, distance is not obsolete, but more frequently, it is silenced. (p. 11)

Her contention is that there is still a difference between being physically present and being visible on a monitor. The nature of the interaction between participants in a face-to-face setting is determined by their negotiated social culture. Is the development of this social culture possible over a video link? Is being seen and heard the same as being present and participating? The suggestion here is that there is still a distance between the remote learner and the

site of instruction that has been 'silenced' by the technology. From this discussion one may ask; 'Is this distance and other restrictions on the ability to form a shared culture perceived by the learner, and if so, how is it perceived, and does it matter?'

A key concept for all areas of distance education as well as face-to-face education is interaction. Moore (1989) defines three types of interaction required for effective teaching practice: learner-content, learner-instructor, and learner-learner interaction, while Hillman, Willis, and Gunawardena (1994) add a fourth: learner-interface interaction. It can be argued that the introduction of this additional interaction category is reflective of a need to attend to the impact of technology on education. With increased use of technology in the delivery of instruction, the focus must not only be on how to use the technology to instruct but also on how the technology shapes the learning experience and on how the adaptation of existing learning skills and tools takes place. Besides being able to connect with the rest of the participants in the learning environment, it is necessary that the participants first develop a comfort level in the use of the mediating technology. The comfortable use of the technology involves more than the ability and ease of the teacher and learners to manipulate the hardware. It also involves behavioral tendencies related to the personal presence portrayed through the technology. Whitworth (1999) relates a case study in which adults in a videoconference course displayed a range of behaviors from being very shy

and hiding from the view of the camera to attempting to act for the camera. None of these behaviors were present in the face-to-face meetings. While people may act differently in the presence of technology, it will be interesting to note how it affects their perception of the learning experience.

Moores' (1989) concept of transactional distance was initially developed from an adult education perspective with the traditional print based correspondence course as a contextual backdrop. With input from Hillman, Willis, and Gunawardena (1994) the technology utilized in delivery was incorporated into the concept of transactional distance. Chen and Willits (1999) have identified three key, interconnected elements of transactional distance which incorporate not only the nature of the technology but also the design and delivery of instruction and the personal characteristics of the participants. The elements of dialogue, structure, and learner autonomy were identified as being interrelated and contributing to learner satisfaction:

> It was concluded that each of these three concepts represented multifaceted ideas. Dialogue consisted of three dimensions: in-class discussions, out-of-class electronic communication, and out-of-class face-to-face interaction. Structure contained the dimensions of course organization and course delivery. Learner autonomy was composed of independence and interdependence. (p. 45)

The findings of their study of these elements of transactional distance in an adult videoconference setting indicate that there was a low correlation

between the use of the three types of dialogue. Those that made use of one type did not necessarily utilize the others. There is an indication that the mere knowledge on the part of the students that they had access to these channels of communication was a significant element in reducing transactional distance regardless of whether they were used or not. This suggests that the learners had an existing sense of what they needed from each of these channels. Where would this sense have come from and would it be as well developed in secondary school students?

Rigidity in course organization was not found to have an effect on dialogue but rigidity in course delivery had a negative impact on in-class discussions. As for learner autonomy, the importance of independence, based on the self-directed nature of adult learners, was supported but the need for learner interdependence was also identified:

> Instructors' recognition of the learners' needs for support and collaborative engagement as well as independence may contribute to enhancing the teaching-learning experience in videoconferencing classes and in all teaching-learning situations. (p. 54)

The multifaceted nature of all teaching and learning situations is hinted at in this last quotation. The interplay between the type and amount of dialogue, the structure of the course, and the positioning of the learners' need for interaction is unique to each learner. The provision of options and flexibility in meeting

these unique needs should, as stated, reduce the perception of transactional distance and increase learner satisfaction.

To this point the concept of transactional distance has been viewed as a single entity that is to be decreased by interaction. Chen (2001) suggests that if four types of interaction can be identified in distance learning then there may be as many types of transactional distance:

> Transactional distance perceived by learners is a combination of four essential dimensions: Learner-instructor, learner-learner, learner-content, and learner-interface transactional distance. Learner-instructor transactional distance involves the psychological distance of understandings and communication that learners perceive as they interact with teacher. Learner-learner transactional distance refers to the psychological distance that learners perceive while interacting with other learners. Learner-content is the distance of understandings that learners perceive as they study the course materials and the degree that the materials meet their learning needs and expectations for the course. Learner-interface transactional distance is the degree of user friendliness/difficulty that learners perceive when they use the delivery system. (p. 462)

While Chen's study of web based distance learning found that the levels of these four types of transactional distance were low, they were still perceived by the learners. The study also found that there was a low level of correlation between these types of transactional distance. The presence of one type of transactional distance did not necessarily mean the other types were perceived as being present in the educational setting. This may be reassuring but at the same time it reminds us of the multifaceted nature of this concept. It may be

tempting to suggest that the use of videoconferencing technology may reduce the number and the extent of the perceived distances but we have to realize that the communication technology is only part of the picture. The organization of the course and the actions of the participants also contribute to changing the perception of distance. This may also suggest that, in general, transactional distance is not perceived by the students as being a big issue. Is this due to the self-reliant, autonomous nature of adult learners? Is this an issue for secondary school learners? To what extent is the reduction of transactional distance necessary in order to facilitate the social construction of knowledge in high school students?

Social Presence and Immediacy

The degree to which videoconference instruction can be considered equivalent to face-to-face instruction is problematic. Kanuka and Anderson (1999) indicate that various forms of constructivist learning theory may be thought of as being at different positions along "a continuum where knowledge is either socially constructed at the one end, or individually constructed at the other end" (p. 1). Parallels can be drawn to the types of transactional distance identified earlier. Learner-content and learner-interface transactional distance may be viewed as more individualistic while learner-instructor and learner-learner distance take on a more social flavor. The social construction of knowledge, as the label implies, is a social process that involves working with

co-learners. Vygotski (1978) suggests that learning takes place when a child interacts with people in his/her environment and that this interaction facilitates learning that would not be possible individually. This concept of working with co-learners implies a reduction in the perception of transactional distance. Ihde (1983) indicates that the introduction of a communication medium between the individual and the perceived world amplifies some aspects of the interaction, but also, reduces or distorts others. If the technology limits the cues that are received or modifies the cues displayed then the nature of the interaction may be markedly different. Whitworth (1999) also states in his reported case study that after the instructor made visits to the remote sites, the quantity and the richness of the communication between the learners at those sites and the instructor increased. The physical presence of the instructor enhanced the learning environment and increased the participation rate even after the instructor had left. The suggestion here is that there is more to developing a social relationship than being visible and audible. Stoll (1999) sums up this idea by stating:

> Salespeople, intent on closing a deal, realize that e-mail and video conferences can not replace the myriad of ways we communicate ideas and feelings in a physical visit. Speakers and musicians, whose livelihood depends on the electricity of a live audience, can't deliver the thrill of a live performance over the Internet. And in each of our lives, I suspect, the most important, most decisive, and most memorable interactions take place in person. (p. 193)

If videoconferencing cannot provide the physical presence of the instructor and learners, can it provide a social presence? Short, Williams, and Christie (1976) coined the term 'social presence' to refer to "the salience of the other in a mediated communication and the consequent salience of their interpersonal interactions" (p. 19). Their research examined a variety of communication technologies with respect to their ability of convey a sense of social presence. The assumption being that the degree to which the communication technology could transmit nonverbal cues would be directly related to its ability to establish a sense of social presence. Print media should convey a lower level of social presence than a telephone conversation, which, in turn, would convey a lower sense of presence when compared to a videoconference meeting. The further people remove themselves from face-to-face communication by breaking the bonds of time and space, the lower the level of social presence conveyed by the medium.

An interesting observation that can be made of Short, Williams, and Christies'(1976) work is that the concept of social presence is identified solely as a characteristic of the medium. No reference is made to the nature of the communication, the actions of the individuals involved, or the purpose of the communication. The assumption in their work seems to be that a medium that conveys a lower level of social presence may have a negative impact on the interpersonal communication. Are there situations in which the social nature

of communication may be a roadblock to the purpose of the communication? If the purpose of a communication is to relay factual information, is there a need for the medium to transmit a variety of nonverbal cues? Taken one step further, can we argue that freedom from the influence of reading, interpreting, and responding to the cues from others has the potential to allow for a more uninhibited communication? The ability of a medium to communicate nonverbal cues provides an indicator by which we can select the medium most suited to our communication needs.

The questions raised in the above paragraph suggest the need for a more comprehensive definition of presence. Lombard and Ditton (1997) have examined the literature relating to presence from a variety of different perspectives. They conclude that the concept of presence in a mediated setting is the ability of the medium to provide "the illusion that a mediated experience is not mediated" (p. 1). Again, the emphasis is placed on the nature of the medium. In examining the literature of presence, Lombard and Ditton have identified six conceptualizations of presence in a mediated setting, all of which, like McLuhans' work, focus on the relationship between participants and the medium. While McLuhans' (1989) work views media as a driving and shaping force in our lives, independent of content, it may be argued from the opposite extreme that it is human agency - the actions, the intentions, the decisions, and the content that form the message. Recognizing the influence of both points of

view, we need to examine not only how the medium shapes us but also how we shape and employ the medium.

With the majority of the research in the area of presence in a mediated setting being conducted by communications and media theorists or by those involved in virtual reality and simulator design, it is no surprise that the focus of their findings is on the nature of the technology itself. One can easily be lulled into believing that if we can master the technology, everything else will follow. As shown above, the definitions of presence, primarily, identify it as a characteristic of the medium and not a characteristic of those employing the medium. There are hints, however, in some of the characterizations that there is a social or psychological component to the concept of presence.

As we move from the literature of the communications and media specialists to that of education, we find a shift away from the emphasis on the media to the ways in which the media are used. Varying levels of personal control over the development of a sense of social presence are evident in the educational use of the term. Short, Williams, and Christie (1976) identified it as a characteristic of the medium and that users would select the medium that would convey the level of social presence required for the given interaction. While Mason (1994) describes social presence as the feeling that the people with whom you are working are in the same room, McIsaac and Gunawardena

(1996) define it as the degree to which one feels socially present in a mediated setting. These definitions seem to link the concept of social presence to a larger social context, which includes recognition of personal motivation, attitudes, and social interaction. Garrison (1997) carries this even further by claiming that social presence is the degree to which individuals project themselves through the medium, either verbally or nonverbally. It has been argued by Gunawardena and Zittle (1997) that social presence is not solely attributable to the medium nor is it only a characteristic of the participants in a mediated setting but a combination of the two. They found that social presence can be developed among teleconference participants by planning their interactions.

How is a sense of presence created? What are the ingredients for creating this sense of presence and what differences exist when comparing its creation in a face-to-face setting to a mediated setting? The vast majority of the educational literature related to presence in a mediated learning environment examines asynchronous course delivery. While freeing the participants from the bonds of time and space, computer mediated communication also removes a number of the cues that the synchronous learning setting provides. These verbal and nonverbal cues that have been eliminated are closely associated with the creation of a sense of presence.

One cannot escape the difference between real and virtual environments and the fact that the communication medium does have a bearing on the creation of the concept of presence. At the same time the actions of the participants, the people who send out, receive, and interpret these cues, contribute to the culturing of a sense of presence. It may be argued the medium is not the message but the bearer of the message. The medium may limit or alter the cues being sent and received but observation of the use of television remote controls suggests that the content is a determining factor in gaining and retaining attention. Both have an important role to play in the educational setting.

Rourke, Anderson, Garrison, and Archer (2001) present a 'community of inquiry model' of the educational experience in a mediated setting. They suggest that social presence, cognitive presence, and teaching presence constitute the learning experience. Cognitive presence is defined as 'the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication' (p. 4). The use of the terms 'community', 'construct', and 'communication' make it very clear that cognitive presence is a social phenomenon. They view social presence as the ability of learners to project themselves socially and emotionally in a community of inquiry. As such it assumes a supporting role

in the development of this community of inquiry and facilitates sustained communication.

Teaching presence includes activities such as "designing and managing learning sequences, providing subject area expertise, and facilitating active learning" (p. 4). In the culturing of a pearl a speck of sand is introduced into the shell of the clam. This irritant stimulates and sustains the development of the pearl. While educators may not appreciate the comparison, it is their actions that instigate and help sustain the learning process through selecting content, setting the learning climate, and stimulating communication. Richardson and Swan (2003) comment on an instructors' ability to create and sustain this learning environment. They reference research on the topic of teacher immediacy as the teachers use of verbal and nonverbal actions that impact on student behaviour. In a mediated setting these teacher actions have to be adapted to the medium or may be restricted by the medium.

Rourke et al.(2001) have set the nature of the communication medium aside and have focused on the identifiable types of presence that create and sustain the learning experience in any setting. Lombard and Ditton (1997), on the other hand, have examined presence with an emphasis on the mediation with a hint of response or reaction from the recipient. The difference seems to lie in whether we wish to identify with the 'reality' of the experience or with

the interaction that the 'reality' promotes. Do we wish to concentrate on how close to non-mediated the experience is or do we wish to zero in on the construction of knowledge and the actions that facilitate it?

Both the nature of the communications medium and the actions of the participants contribute to the level of social presence experienced. Gunawardena and Zittle (1997) have found that social presence is a very strong predictor of satisfaction in computer conference settings and that, while the ability of the medium to transmit nonverbal information contributes to social presence, the immediacy behaviors of the individuals involved contribute more. They state that interactive television or video conference delivery are mediums that are rich in social presence:

> [T]he social presence of a communication medium contributes to the level of intimacy that depends on factors such as physical distance, eye contact, and smiling. (p. 9)

But they add that the ability of the instructor and other learners to use these cues to reduce the transactional distance between those involved is a crucial factor in determining satisfaction levels:

> Characteristics often associated with CMC (computer mediated conferencing) - interactivity, collaboration, and reflectivity - are not inherent within the medium but can result based on design, moderator roles, participation patterns, and involvement. It is these skills and techniques rather than the medium that will ultimately impact students' perceptions of interaction and social presence, which will influence their satisfaction. (p. 15)

The fact that the characteristics noted above are not inherent in the technology on one hand removes the focus on the medium while on the other makes us aware of the need to consider and plan the actions of the participants.

The primary responsibility to focus on actions to increase social presence has been placed on the instructor. Hackman & Walker (1990) found that the immediacy of the instructor had a positive effect on student learning and satisfaction in a videoconference setting. They have relied on Mehrabian's (1969) definition of immediacy as "behaviors that enhance closeness to and non-verbal interaction with another" (p. 203) and have included actions such as offering individual attention, encouragement, using vocal variety, and demonstrating relaxed, natural, non-verbal behaviors as examples that foster immediacy. Hackman and Walker (1990) indicate that the use of immediacy behaviors conveys a social presence of the instructor - makes the instructor seem to be real in the eyes of the learners. While their study examined the actions and the perceptions of the instructor and their effects on performance and satisfaction, there appears to be little work done on the social presence of fellow learners in a videoconference setting. Provided the opportunity, the immediacy behaviors of fellow learners may also increase the social presence, and in turn, the satisfaction level of all participants. Given the identified differences between adult learners and school aged students noted by Collis (1996), it could be argued that behaviors that enhance social presence may be

more important in the secondary school setting. Unfortunately, the lack of research at this age level leaves this question unanswered.

The development of social presence and the characteristics of immediacy rely very heavily upon non-verbal cues in communication. These cues are present in face-to-face communication and also in a videoconference setting. At first glance one would think that these cues would be identical in both settings but Nichol and Watson (2000) suggest that:

> in relation to NVC (non-verbal communication) two elements fundamentally differ between face to face and videotutoring: the two dimensionality of the screen and its role as a viewing frame, "the prisoner of the window" effect. (p. 138)

They argue that the two-dimensional nature of the video monitor not only changes the scale and perspective of the classroom environment but also reduces the field of vision and creates a picture that is an illusion of reality. The learner is only receiving part of the picture. They suggest that the development of social presence of the instructor or other learners is not dependent on cues from one individual but on the interpretation of multiple cues from all involved. This simultaneous interpretation of cues from all participants may be missing in a videoconference setting. Does this delay the development of a classroom culture and, in turn, impede or restrict the social construction of knowledge?

Nichol and Watson (2000) also suggest that elements of non-verbal communication such as body movements, facial expressions, and gestures can be transferred via videoconference technology but gaze or eye contact is difficult to read and achieve. Participants are viewing the monitor and not the camera. The use of eye contact to monitor cognitive activity, to regulate the flow of communication, and to monitor feedback is limited in this environment. This, accompanied by the difficulty of continually focusing on a small area (monitor), may create or increase the transactional distance between the learner and the instructor. While videoconference technology provides a medium for developing social presence that is superior to other technologies, one must not forget that all the cues present in face-to-face communication are not present in the two-dimensional images viewed in a videoconference setting. What level of social presence will sustain interest in the secondary school learner? If some of the non-verbal cues or the interplay between multiple cues are absent, are they replaced by other cues that perform the same task? How do the students adapt their learning strategies to this setting where cues are absent or modified? Do the same learning tools and processes work in this new setting or are they modified? If so, how?

If face-to-face instruction is the most common mode of instruction, why bother with videoconference delivery? The usual answer is that, due to geographic location or scarcity of resources, the instruction is not available in the traditional format. The decline in rural population, the economic restraints on

school jurisdictions, and the decline in availability of qualified instructors in specialty areas has led to the use of technologically mediated instruction. How does this mode of instruction effect student performance and attitudes towards instruction? According to Westbrook (1997) academic performance of students at remote sites is equivalent to if not better than that of those attending the course on campus and their attitudes towards the videoconference instruction were positive. Having the instructor teach the class from each of the remote sites, the students felt that there was sufficient contact to support learning. At remote sites where there is more than one learner it has been found that the level of collegiality at the remote site develops much more quickly than it would in a face-to-face setting. There is a belief that the members are a class within a class (Thach and Murphy 1994). Similar findings were found in a study by Wynia (2000) in which a number of college level students taking a course by interactive television were asked to rank their level of satisfaction with the instruction received. The results confirmed the higher level of satisfaction at the site where the instructor was located but they also indicated that "[some] students needed the face to face interactions with instructors in order to feel they were succeeding"(p. 41). Age seemed to have a bearing on the need for communication outside of the classroom:

> Younger students expressed problems with levels of communication. Eighteen to twenty year olds in remote ITV classrooms ranked the satisfaction level of communication outside a class as "strongly dissatisfied". Their same age peers in the ITV originating class ranked the same communication factor as "strongly satisfying". (p. 41)

While this study was conducted with college level students the above finding may indicate a need for out of class communication channels for younger secondary school students receiving instruction in this format, emphasizing, again, the need for social interaction to help facilitate learning.

Presence, Culture, and Place

The field of distance education is characterized by the separation of the teaching and learning activities by location and time (asynchronous) or at least by location (synchronous). In a videoconference setting the interaction occurs in real time but the separation or distance between the instructor and the students creates a learning environment different from that experienced in a face-to-face setting. The literature reviewed to this point focuses on this separation and activities or behaviors that can promote a sense of presence where physical presence is not possible. The notion of presence implies that the nature of the place or context in which learning occurs is important. Attention has been directed to the immediate context of the technological environment of the videoconference classroom. We must recognize that this learning environment constitutes a small part of the students' ongoing educational experience. What role does this broader context play in the activities in

the videoconference setting and how does this experience fit into this broader context?

Bruner (1996) has described the classroom as a 'micro-culture of praxis', a location characterized by a customary mode of behavior. In face-to-face instructional settings, this negotiated social culture is determined by the unique personal histories of the participants, the culture of the school, as well as the community context in which the school resides. All of these factors contribute to the nature of the interaction that takes place.

As we move from traditional educational settings to mediated environments we create the need to renegotiate this shared social culture with participants from differing 'micro-cultures'. Also, the traditional channels for negotiating this shared culture have been replaced or altered by the introduction of videoconference technologies. Crook and Light (1999) have stated that:

> [O]ur results confirm us in the view that students are enculturated into particular communities of learning, and the resulting practices will offer resistance to the bolting on of new educational technologies. (p. 191)

Can new cultures be developed through these mediated channels or will there be resistance to doing so? Is there sufficient time in a five-month

semester to develop new customs, attitudes, and skills required for success?

Cultures do not reside in a vacuum but occupy a place which prompts and supports particular attitudes and behaviors. Crang (1998) distinguishes between the notions of 'space' and 'place' in the context of cultural geography. The former being a location while the notion of 'place' implies an established history, cultural supports, and the promise of a future:

> Spaces become places as they become 'time-thickened'. They have a past and a future that binds people together around them. (p. 103)

Are these cultural differences perceived by students in a videoconference setting? Is there a resistance to change caused by the 'bolting on' of educational technologies? And, can these technological spaces become learning places? Are these questions that enter the minds of secondary students in a videoconference environment and do they influence their perceptions of the experience and their behaviors in this setting?

Conclusion

There is ample evidence in the literature establishing that delivery of instruction via videoconference is not identical to face-to-

face instruction. There is a distinct qualitative advantage to the presence of not only the instructor but also other learners. Due to geographic and economic factors, face-to-face instruction may not always be an available option. In its absence, videoconference delivery at the post secondary level may be a viable alternative with the proviso that instruction is designed to maximize learner involvement and participation. Unfortunately, little or no research has been conducted on the use of this mode of delivery at the secondary level. As with any technology, primary consideration must be given to the pedagogical needs of the learner and structures must be put in place to meet these needs. Obtaining more information on students' perceptions and experiences of videoconference delivery as well as monitoring the changes in these perceptions over time may assist us in making the best use of this technology.

Chapter Three

Methodology

Purpose of the Study

Knowing glances, feelings of shared experiences, and feelings of social presence are characteristics that are difficult to quantify and measure. The purpose of this study, therefore, was to gather and examine the experiences of high school students taking a course by videoconference. Through the examination of these experiences, questions of the relevance of social presence, the relationship of this experience to traditional classroom learning experiences, and the learning tools and strategies students employ in this environment emerged. Few published accounts exist concerning student satisfaction in the area of videoconference course delivery (Binar, 1993) and even less has appeared in the area of the quality of the learning experience from the perspective of the learner.

Through examination and interpretation of student experiences as well as through observations, patterns in the learning tools and processes used by students (both successful and those not so successful) were explored. By examining the students' experiences from a learning process perspective rather than an educational outcome perspective, different learning paths may emerge

in a videoconference setting as compared to a traditional instructional setting. While performance outcomes may be the same in both settings, the resources, tools, and strategies used to reach those outcomes may differ. The plan of this study was to examine the experiences of students as they adapt to a new form of course delivery and to identify the factors attributed to that adaptation. The emphasis was on the adaptation process rather than the academic outcome of the courses taken and, as a result, provide insights to inform and guide future practice. It should be noted that academic achievement may be a significant influence on the adaptation process but an interpretive rather than an evaluative stance was taken. By inquiring about students' perceptions of social presence of both the instructor and fellow learners perhaps the influence and significance of these factors in the learning experience can be determined.

Research Approach

The intention to make student observations and to gather information by conducting student interviews and through email correspondence situated this study within the qualitative realm. Denzin and Lincoln (1994) state that "qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them" (p. 2). Focusing on student experiences, the learning strategies

brought to the setting, and the changes that occur over the duration of the semester not only identifies this project as qualitative research but also emphasizes the importance of the context in which the learning takes place. In this case, the context was one of the key characteristics of the study. Bogdan and Biklen (1992) indicate that "to divorce the act, word, or gesture from its context is, for the qualitative researcher, to lose sight of significance" (p. 30). In this study the examination of the physical context of videoconference course delivery as well as the social context of the learner may yield important findings that could influence subsequent practice and approaches.

This study is a case study informed by student observations, semi-structured interviews and student narratives. Merriam (1998) has described case study research as "the intensive, holistic description and analysis of a bounded system" (p. 19). In this case the study was bounded both by clearly identified program participants and by a fixed time period and location. This study examines the experiences of a limited number of students taking a course offered by videoconference in a large rural school division in central Alberta. Eligible participants were restricted to those students taking the course at a site remote from the location of the instructor. The duration of the study was restricted to a five-month high school semester.

Merriam (1998) indicates that case studies, regardless of topic, can be classified as descriptive studies in which a detailed account of the phenomenon is presented, interpretive studies in which "descriptive data are used to develop conceptual categories or to illustrate, support, or challenge theoretical assumptions held prior to the data gathering" (p. 19) or evaluative studies which provide judgements about the worth of a given program. For the purpose of this study an interpretive approach was taken. This study did not judge the academic achievement of the students in this program, instead, sought to describe and interpret the experiences of those involved. Through this inductive analysis of observations, interviews, and conversations, a clear picture of the learners' experiences was gleaned, not for the purpose of developing abstract theory about videoconference delivery, but to assist in the practical purpose of guiding and informing future practice.

Qualitative research, and case study method in particular, is characterized by the use of multiple methodologies. Merriam (1998) has indicated that case study research can be combined with, or borrow approaches from, a variety of research types (e.g. ethnography, phenomenology, and grounded theory) while Denzin and Lincoln (1994) label qualitative research as bricolage and the researcher as a bricoleur or "jack of all trades" (p. 2). With

the purpose of this study being to gain insights into the experiences of students, a variety of approaches was employed to obtain a better understanding of the research question. Observations focused on verbal and non-verbal interactions, conversations, and interviews were employed to not only obtain a picture of the student's view of the experience but also to identify the context in which that experience resides. Through analysis of the data and reflection upon it, a connection between these experiences and their contexts was discerned. In addition, the changes, and their extent, that occur over time in students' perceptions of their learning in a videoconference delivered course were examined.

Participant Selection

The target population for this study was those high school students taking a course delivered by videoconference. At the time of this study, in the province of Alberta, this population was relatively small. The school division in which this study was conducted planned to use this mode of delivery for specialized high school courses that had low enrolment numbers in individual schools but, divisionally, had enough students to warrant the delivery of the courses.

A convenience sample of six students initially registered in an academic Math 31 course by videoconference at a remote site was used. This represented the entire group of students taking the Math 31 course at a site remote from the teaching site. This sample matched one of the target groups identified by the school division and the results of this study provide insights applicable to that group in the future plans of that division. A variety of videoconference applications were employed by the division (e.g. daily course delivery, short term modular course delivery supplemented by independent study, and coaching of students taking traditional correspondence courses). A random sample across this population would not provide a sample that shares common experiences. It was important that the participants selected be articulate and willing to talk with me about their learning experience. It was preferable that the students selected be those that have not taken a course by videoconference prior to this study. My primary aim in this case study was to provide an accurate and complete account of the experiences of students taking a course by video conference that is likely to resonate with those who instruct video conference delivered courses.

Data Collection

Data collection for my study included student observations, semi-structured interviews and email correspondence. Through deliberately planned and routinely executed observations, information that helped define the context of the experiences was gathered and used as reference points for subsequent interviews. Observations were conducted weekly by videoconference while the class sessions were in progress. Being able to focus on the actions and interactions of the participants allowed me to record both the verbal and non-verbal activities of those involved. Boostrom (1994) has outlined the stages that observers pass through on their journey to understanding what they observe. The diagram below outlines these stages.

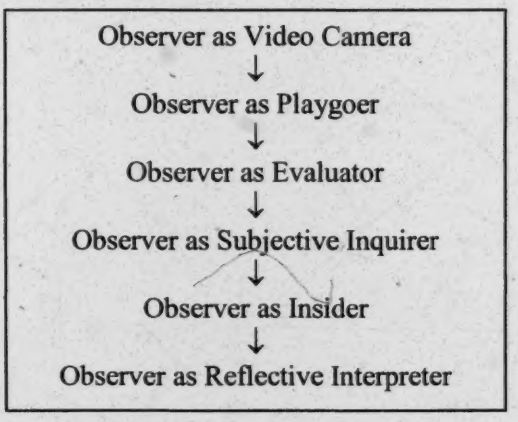

Figure 1: Developmental Stages of an Observer

Notes including descriptions, quotations, and personal reflections were taken during these observation sessions, keeping in mind my progression through the stages mentioned above. Knowing the nature of the next level of observational functioning provided an incentive to 'look' in that direction.

In addition to observations, data were gathered from semi-structured interviews based on questions stemming from the observations made. I met with the students a total of five times. The first meeting took place by videoconference before the course began and included the teacher of the course as well as myself. This meeting allowed for the introduction of the course teacher and provided an opportunity to outline the nature of the research project. Also, an opportunity was provided to discuss any preconceptions or issues that the students had related to this mode of delivery. The remaining four interview sessions were conducted, in person, on a monthly basis and involved attending the class period followed by individual interviews with each of the students. These interviews were taped, transcribed, and arranged chronologically. I transcribed each of these tapes to produce a print copy of the interviews. These tapes provided insights into the perceptions of the students involved, helped correct any misconceptions, generated ideas for future interviews, and provided a record of any changes in perception that may have occurred during the study. In conducting these interviews, the researcher

begins from a stance of concerned engagement (Ellis, 1998) and takes "conscious responsibility for [the] interpretation of the other person" (p. 30). The well being of the participants and their increased understanding of the experience through verbalizing their perceptions were of primary importance. To help facilitate this, interviewees were asked to review transcripts of their interviews to see if they were an accurate representation of their comments. These transcripts, along with questions that emerged from the conversations, were emailed to the participants for review and comment. Through repeated interviews, conversations, and email correspondence any misconceptions on the part of the researcher were clarified and in turn, as suggested by Weber (1986), the nature of the experience in the minds of the participants was clarified. In addition to questions related to student perception of social presence and learning strategies employed, open-ended questions relating to the videoconference experience were also asked. The use of open-ended questions, as stated by Ellis (1998), helps to evoke memories or experiences that are relevant and important to the participant, thus allowing what is important to the person to emerge rather than pulling comments on what is important to the researcher. While the interviewer enters the conversation with preconceptions it is important to allow the perceptions of the participants to drive the exchange.

Comments and stories initiated through interview questions and student conversations constitute the primary data source in this study. Clandinin and Connelly (2000) state that "experience happens narratively" (p. 19). Our experiences are fragments of stories that link together to form our understanding of life and our place in it. Through examining these stories we gain insight into what issues and factors are significant to the participants as well as identifying how they make sense of these issues and factors within their experiential framework. This study relied on the stories told by the students not only to provide student perceptions of the learning experience but also to help identify contextually relevant characteristics of videoconference instruction. By examining these comments and stories over the duration of the study I was looking for changes that occur in individual student perceptions of the educational experience as well as patterns and themes, shared by all participants, that emerge from their stories.

To gain as complete a view of the experiences of the students in this study as possible, a variety of data gathering techniques was employed. Student observations initiated the inquiry process. Questions such as the following provided a framework for structuring my observations.

- What are the students' initial reactions to the learning environment?
- How do they respond to the instruction and the medium of instruction?
- How would I feel if I were in their position?

The data gathered from these initial observations and subsequent personal reflections led to the development of interview questions that helped to uncover the students' initial perceptions of the learning situation and identified how it fitted in with their traditional classroom experience. Findings from initial observations were clarified. Repeated observations were made throughout the duration of the semester accompanied by a series of semi-structured interviews that helped clarify any misconceptions and identified changes that occurred in the perceptions of the learners over the duration of the course. Through the accounts gathered from these various sources a fuller understanding of the videoconference experience, as viewed by secondary school students, was obtained.

The data gathering process identified above may seem to be linear in nature (at least chronologically) - beginning at the start of the semester and continuing through until the semester ends. However, the process took on a more recursive nature. Ellis (1998) states that:

> When a study is viewed as a series of loops in a spiral, each loop represents a different attempt to get closer to what one hopes to understand. One enters each loop, or separate inquiry, with a question. What one learns in the loop provides direction or a reframing of the question for the next loop. (p. 22)

Entering this inquiry with the purpose of trying to gain an understanding of the videoconference experience through the eyes of the students left the doors wide open as to the direction that this research could take. While I personally believe that the phenomenon of social presence is significant in the learning experience and that there may be differences in the learning strategies employed by the learners in this context, if these beliefs do not emerge as significant in the minds of the students I must be open to the issues that do concern them. Listening for and capturing their joys and their concerns provided the tools with which to reframe questions and direction for the next stage of the inquiry.

Data Analysis

Two approaches were taken in the examination of the learning experiences of a limited number of students. First, their experiences were examined individually identifying any changes that occurred over the duration of the course delivery. From this perspective, answers were found to the

question "How do the learning strategies used in traditional classroom instruction translate to this environment?". Also, insights were found as to how those strategies changed and developed over time. Similarly, activities, behaviours, and processes that enhance or detract from the feeling of social presence for each student were identified along with the relative importance that these factors play in student satisfaction. The second approach taken in the examination of students' experiences was to look for common themes or patterns. Physical and social contexts that influence these common themes or patterns were sought. The identification of these patterns may be used to guide and inform future practice.

The interpretation or analysis of the data gathered was not a process initiated after the last piece of data was gathered. Instead it was an ongoing process that determined the next stage of the inquiry. It structured the nature and the direction of each repeated attempt to get closer to understanding the experience of the participants. Polkinghorne (1995) uses the term "narrative analysis" to identify a "task [that] requires the researcher to develop or discover a plot that displays the linkage among the data elements as parts of an unfolding temporal development" (p. 15). In this study the individual accounts of each participant were examined to identify any changes in perception that occurred

over the duration of the study. What beliefs, values, and interests had been identified and how had their relative significance changed over the allotted time? How had the context changed and how had the perception of the context changed? In order to answer these questions, data were examined for common themes and patterns that occurred in the experiential journey of each participant.

Polkinghorne (1995) used the term "analysis of narratives" (p. 13) to represent this use of accounts to produce generalizations. This study is not a grounded theory approach so no attempt is made to establish abstract theory based on the experiences of the participants. Any similarities, patterns, or themes that emerged were noted solely for the purpose of recording their existence. The purpose of this study was to provide an interpretive account of the experiences of students taking a course by videoconference. Any identified themes, patterns or insights that surface in the stories may be used as a starting point for future endeavours in this field and are not used for the formation of abstract theories in this study.

How does one interpret? Examples of interpretive work abound but no detailed generic recipe exists for the process of interpretation. What does exist,

though, is a framework or context within which this inquiry process takes place as well as a cyclic process of inquiry and reflection. Clandinin and Connelly (2000) state that stories exist in a "three-dimensional narrative inquiry space with temporality along one dimension, the personal and the social along a second dimension, and place along the third" (p. 54). This structure provides not only a bounded space to start the inquiry within but also provides dimensions around which questions can be constructed. What past does the student bring to the setting? What aspirations are held? What is happening in his/her life now? What social interaction is taking place and how is it perceived? How is the videoconference setting affecting the experience and what is happening outside this class that may be influencing the activity? How does this part of their life affect the whole and vice versa?

Once located within that bounded three-dimensional space, a cyclic process of inquiry and interpretation can occur. In the initial inquiry, Ellis (1998) indicates that prior understandings and beliefs are used to gain an initial understanding of the situation or participants. This is followed by a reflective, evaluative arc in which the data gathered are re-examined to interrogate the initial interpretation. I identify what is missing from, what confirms, and what contradicts my initial understanding. At this point "alternative interpretation

frameworks are purposefully searched for and tried on." (p. 22). If my initial belief in the importance of social presence in learning does not materialize in the comments of the participants, alternative structures will be sought. The cycle is repeated with another forward arc seeking to clarify the understanding gleaned from the first reflection.

Providing a holistic description of the case being studied as well as trying to convey an understanding of this case were the primary considerations to be made in analyzing the data. What were the indicators to consider in achieving these aims? The syntheses that unfolded within the three-dimensional context or space described previously were verbal and non-verbal communications. The language used by the participants was analyzed not only for its content but also from the perspective of the voice and tone used to convey the message. This study examined the various data sources to find the ideas expressed as well as discerning the roots of and the implications of the issues raised. Any metaphoric language used was questioned and particular attention was paid to identifying what was not said within the given setting. In addition, observations focused on the non-verbal communications that occurred among the participants. The knowing glances and the body language displayed

conveyed information just as the tone and expressiveness of the speech conveyed meaning beyond the words used.

Role of the Researcher

In a qualitative study, Merriam (1998) states that the researcher is the "primary instrument for gathering and analyzing data" (p. 20). She goes on to state that the researcher must have a tolerance for ambiguity, be sensitive to the context and the participants in the study, and be a good communicator. Yin (1994) elaborates on these characteristics by identifying five skills that a researcher should possess in order the conduct a case study. These include being able to ask good questions, being a good listener, being adaptive and flexible, having a firm grasp of the issues being studied, and being unbiased by preconceived notions (p. 56). With this in mind, my focus was on refining the questions asked to allow the issues of interest and concern to the participants to emerge and to be attentive to the context within which the participants spoke. In this case study, the characteristics of being a good listener involved not only capturing what was said but also what was left unsaid in both verbal and non-verbal ways. The open-ended nature of this study required the ability to pick up on unexpected opportunities presented by the participants. With the probable twists and turns that can be expected in the data gathering process, it

was important that I enter the study with a broad background, not only in the theory of technologically mediated instruction, distance education, and the social aspect of learning, but also, be aware of the findings of other similar studies. Such a broad background helped ensure that I was not looking only for data that supported a narrow view or preconception of the nature of the students' experience of a videoconference delivered course. All effort was made to be sensitive to information that deviated from the expected and that may have been contradictory to existing theory or research findings.

No one comes into a research activity with a blank slate to be written on by those involved in the study. The researcher and the participants enter with unique histories and adaptations made to those histories. Their view of the world is shaped by their knowledge and understandings of the world. My role as the researcher was to be aware of what I brought to the setting. These pre-understandings included not only the situational knowledge about the nature of technologically mediated learning but also my personal beliefs and values related to the nature of education. This vantage point must be made clear so as to identify a starting point in my understanding of the case being studied and the history that 'mediates' my interpretation of the observations made. When interpreting the words and actions of the participants it was important for me to

be aware of my personal beliefs in relation to the participants, especially those beliefs that differ. Ellis (1998) states that "to understand another, one does not surrender one's own standpoint and grasp that of another but a fusion of horizons takes the form of broadening one's own horizon through a dialogical encounter of questions and answers" (p. 16).

Limitations and Delimitations

The sampling method used in this study restricted participation to a small number of students located within one school. The characteristics of this school may not be representative of similar sized rural schools. In addition, the characteristics of students taking Math 31 are not likely representative of the general high school population. This study was also limited by the willingness of the participants to reflect on their experiences and to share those reflections.

This study was purposefully delimited to a full semester course where the entire instruction was teacher directed and provided in a videoconference setting. The findings of this study may not be applicable to other applications of videoconference instruction such as short term, modular courses, videoconference coaching or tutoring of students taking courses by correspondence.

Assumptions

This study was based upon the assumption that valuable insights into the videoconference experience can be obtained from a small number of participants. It also relied upon the belief that high school students can identify and articulate issues related to their learning experience and are willing to share these with the researcher.

Conclusion

This project is a case study of six students registered in a Math 31 course delivered by videoconference. These students were located at a remote site and were asked to relate their experiences over the semester of instruction. Observations, semi-structured interviews and email communications were used to collect data related to the students' perception of the importance of social presence and the adaptation of student learning strategies in the videoconference learning experience. The data collected were examined to determine what changes, if any, took place in individual students' perceptions of the experience as well as for patterns and themes that emerged from the responses of more than one participant.

Chapter Four

Results of the Study

The data gathered in this study came from several sources: a videoconference meeting with the teacher and students prior to the beginning of the course; weekly observations made by videoconference while the class was in session; four personal visits to the remote site involving individual student interviews and email correspondence between personal visits. The monthly personal visits involved sitting in on the class one day followed by individual student interviews the following day and concluded by attending the class at the end of the second day. The email correspondence involved returning a transcript of the personal interviews to the participants so that they could check for accuracy and to solicit comments along with any questions that emerged from our conversations. In some instances the electronic dialogue continued beyond the initial response while in other cases the reply confirmed the accuracy of our conversation and little else.

Describing the Setting

The Math 31 course was offered through a point-to-point videoconference link between two small towns in central Alberta. The host site was located in a geographically isolated community whose economy is based on resource extraction and whose population has

fluctuated recently due to cyclic mine and mill closures. The remote site was located in a very stable community with a variety of mercantile and tourism support businesses.

An experienced female teacher who had taught the Math 31 course in the past instructed the course. Due to declining enrolments at her school she had not been able to teach this course in the past few years. The opportunity to teach this course again, albeit in the videoconference setting, was greatly appreciated by her and she spent more time and energy in developing distance-based course material for delivery in this format than she would have done in a face-to-face format.

The course ran daily in the 2:30 PM to 3:30 PM time slot based on the host site's timetable. Daily classes at the remote site ended at 3:10 PM so this course ran 20 minutes beyond the normal end of school. The remote site did run a senior physical education course daily from 3:10 PM to 4:10 PM. Three of the students enrolled in the Math 31 course also took this physical education course and chose to leave the math class early to attend their other class.

The videoconference system employed by the school division ran the H.323 standard and the classes were connected at a rate of 384

kb/sec. The hardware employed allowed the instructor to initiate the point-to-point connections for the regularly scheduled classes and also allowed for multi-point connections. The remote site and the host site were separated by 220 km and connected by copper land lines for this course. This course was delivered before the fibre-optic *Supernet* network was activated in this division. Due to the distance between the two sites and the relatively low transmission rate, there was a slight delay in the audio and video between sites. The research observation site was located in a third town that was 200 km from the remote site and 250 km from the host site. The videoconference system allowed for instructor-initiated multi-point sessions that were used for classroom observation. The diagram below illustrates the relative locations of the sites used in this study.

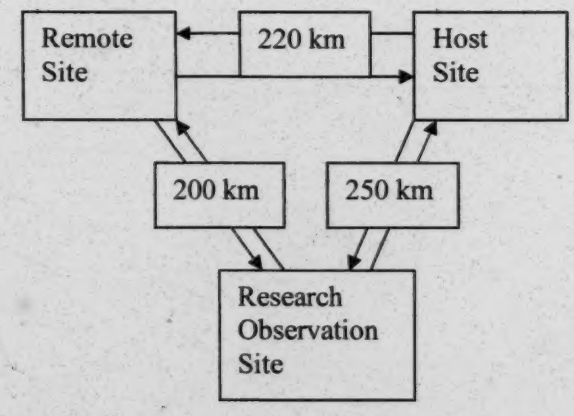

Figure 2: Site Location Diagram

At the host site, the videoconference suite was located in a regular classroom with seating that could be arranged in a variety of configurations. The remote site had the suite located in a small room that had been partitioned off from a large classroom. Space was at a premium with little opportunity for changing the configuration. Each suite was equipped with four, 32-inch CRT monitors, a single camera, a document camera, a computer link, and a multifunction printer that allowed for printing, scanning, copying, faxing and emailing of material between sites. Ten days into the course an interactive whiteboard was activated in each site. Three of the 32-inch monitors were located at one end of the suite while the fourth was positioned next to the interactive whiteboard so that the students could watch the whiteboard as well as see the instructor on the monitor. For this point-to-point configuration only three of the monitors were used. One displayed the local class while the other two displayed the remote site – one located near the front of the classroom and the other, with the same image, located beside the whiteboard. At the remote site the seating was arranged in a U-shape facing the three monitors along the front of the room. One branch of the U contained the computer link as well as the document camera. Seating for the students was restricted to the bottom and one branch of the U. Adequate space was provided for students to spread out their books and papers. The diagram on the next page illustrates the room layout.

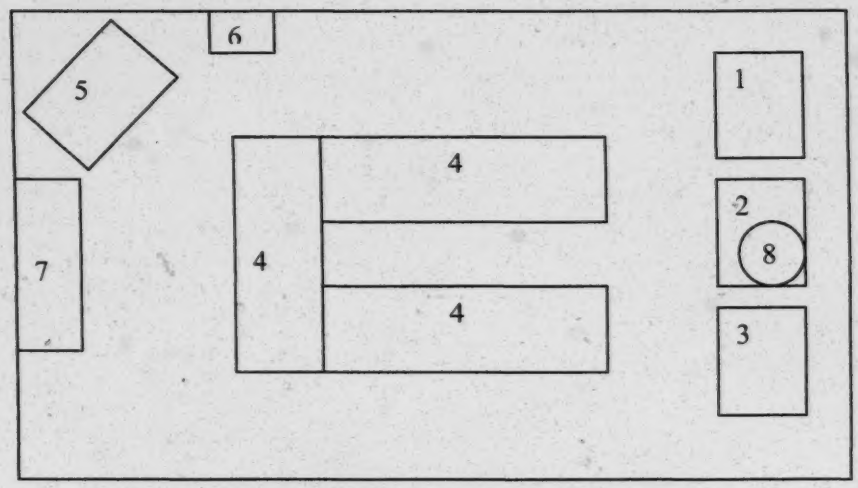

Figure 3: Remote Site Room Layout

1, 2, 3, 5 – 32 inch monitors
4 – student tables
6 – multi-function printer
7 – interactive white board
8 - camera

The school division in which this study was conducted had set aside funds on an annual basis to pay the teacher costs of delivering videoconference courses. In the short term, while different applications of videoconference delivery were being tested, the funds earned from Alberta Education due to the students completing the courses flowed to the schools where the students reside. This provided a situation in which individual schools received funding from Alberta Education for students completing videoconference courses without having to pay for the instructional time involved in delivering these courses. The

administration at the remote school was very active in encouraging its students to take advantage of these increased opportunities.

Remote Site Participants

At the start of the course there were ten students registered at the host site and six students registered at the remote site. For this study, only the students at the remote site were observed and interviewed. The following information and descriptions of the remote site students are based on five months of personal interaction with them and on information volunteered by the course teacher and the administrator of the remote school. All students involved in this study had attended the same junior/senior high school for the duration of their secondary schooling. Pseudonyms are used to protect the anonymity of the participants.

Bob

Bob was an honours student with a very clear direction in his life. He was involved in the student council and was the editor of the school's yearbook. He took both responsibilities seriously, not only from the perspective of completing the tasks assigned but also in preparing younger students to fill these roles by the time he graduated. Bob was well liked and respected by the student body. He had aspirations of entering university in the field of journalism and had an

interest in international affairs. He had spent the previous summer in Ghana on a student exchange and looked forward to doing more traveling. Bob became rather frustrated on occasion when things did not work for him but he handled such situations well and was not afraid to ask for help. When he did ask for assistance he was very articulate and could describe accurately what he did not understand. Bob worked quietly in class but was more than willing to provide assistance to other students when asked.

Cindy

Cindy was also an honours student who set a very high standard for herself and others. She had a clear idea of how the world should operate and, when it did not, those around her heard about it. Cindy worked hard at her studies but also balanced it with an active social life. She knew how much time she was willing to devote to her studies and also knew when expectations started to cross that line. She was critical of anything that did not contribute to the efficient completion of a task. She was involved in the graduation committee and took a significant role in the planning of the graduation activities. Cindy was well liked by her classmates and they had become accustomed to her occasional outbursts, realizing that she would soon return to 'normal'. In some cases, they admired her for stating what they had been feeling but were not brave enough to verbalize. When students outside the classroom

became too noisy, Cindy was the one to 'direct' (not ask) them to move on. Cindy had not made definite plans for post secondary education but was leaning in the direction of business administration.

Mark

Mark was a very laid back student who seemed to be wise beyond his years. He had a very easygoing personality and related well with all students. He seemed to be the one student who was accepted into any social group within the school and was admired by both the student body and the administration. He had the ability to step back from a situation and to analyse what was going on. Of all the students in this study, Mark was the one who spent the most time with me, discussing not only the videoconference project but also numerous other topics. He aspired to study political science and was looking to travel to Germany in the summer. Mark enjoyed mathematics and caught on to new material very quickly. He was often asked for help and provided it willingly. Mark was a mediating influence in the class and helped to insure that things ran smoothly. His computer expertise helped in making the class run smoothly from a technical perspective.

Mary

Mary was a hard working student who struggled with mathematics. She had a very positive attitude and always looked for

the good that could come out of every experience. She was involved in the graduation committee and had the ability to organize people. Mary was very supportive of her peers and looked forward to studying to become an elementary school teacher. She was interested in the learning process and was particularly interested in the effects of technology on the classroom. Mary spent a considerable amount of time on her studies and felt that any difficulties could be overcome with more time and more work. She was a close friend of Cindy's and the two of them spent a considerable amount of time working together on the Math 31 course. Mary was one of the students enrolled in the senior physical education course that required her to leave class 20 minutes early each day.

Gary

Gary was a quiet student who did not interact very much with the students in the class. He indicated that this was not the group of students that he normally associated with but took the Math 31 course because it was a prerequisite for the post secondary program he had chosen. Gary is the only student who had been involved in a videoconference course prior to taking this math course. He had taken a short, one-credit Career and Technology Studies (CTS) course in

tourism in the first semester. This was a five-week course that involved lecture, independent study, a field trip, and a project. He found the nature of the content of the math course differed considerably from the CTS course. Gary's parents had separated a month prior to the beginning of the course and he was finding it difficult to cope with school and the changes at home. Gary was also involved in the senior physical education course.

John

John was a curiosity seeker and hovered around the fringes of the school. He expressed an interest in a wide variety of topics but did not focus his attention on any for an extended period of time. His attendance at school was sporadic and he did not have close ties with any of the students in this class. During my interviews with him, the topic of discussion soon deviated from the videoconference experience to other aspects of school, characteristics of the school that I taught in, and life in general. John was one student who corresponded with me by email on a regular basis even though the topics of discussion were not focused on the videoconference experience. During the classes I attended at the remote site, John felt comfortable in asking me questions related to the course content and indicated that he needed a little more personal direction than he was receiving from this environment. He did not work on math with any of the other students

in the class and did not seem comfortable in asking them for assistance. John was also enrolled in the senior physical education class.

Observations and Student Perceptions

What follows is a chronological description of the observations and student comments over the duration of the five-month course. An introductory meeting was held by videoconference on January 28, 2004, just prior to the beginning of the course. This was followed by four personal remote site visits that occurred on February 19, March 22, May 4, and June 10, 2004. Classroom observations and individual interviews were conducted on each of these visits followed by email correspondence to confirm or clarify the data gathered.

Events of January 28, 2004

It never rains but it pours! It never gets cold but it was minus 43 degrees Celsius that morning! That was cold on any scale and placed a definite limitation on mobility. Today was the day I had planed to meet with the Math 31 students at the remote site. The Math 31 teacher, Mrs. A, was to meet me there and we were going to spend some time familiarizing the students with the videoconference technology and introducing the layout of the course. The plan had been to spend some time getting to know the students, their expectations, fears and concerns, to discuss this research project, and to distribute the required

permission forms. After a few phone calls the meeting was switched to a videoconference session. We'll see what we can accomplish at a distance.

Fifteen minutes before the scheduled meeting time I made the videoconference connections between my school, the host school and the remote site school. What came into view was the back of one of our technicians standing on a ladder in the middle of the videoconference suite at the remote site. He was installing the ceiling mounted projection system for the interactive whiteboard. He was wearing a tool belt weighted down with the required tools for the installation. This did not look good in more ways than one. The students arrived as the technician and I wrapped up a good-natured discussion of lunar phases, Big Brother, and the union's view of spying on its members. Fortunately, Mrs. A joined the conference after the technician left the room. All of the furniture had been moved to one side of the room and most of the equipment had been disconnected to allow for the installation of the projection system. All that was functioning was the camera and the monitors. So much for familiarizing the students with the use of the equipment.

The students assembled in the corner of the room, some stood, a few sat on the available chairs, and the girls sat on the laps of the seated

boys. I could not help but think the image on the screen resembles a family portrait. There appeared to be a level of familiarity and comfort amongst the students in this smaller school that may not be present in larger schools. Introductions were made and it was suggested that the students maintain their current seating arrangements to help facilitate learning their names. A good round of laughter was followed by the comment that they wouldn't mind but they were afraid their full attention would not be directed towards their studies.

We familiarized the students with the use of the remote that controlled the camera. The students took turns pointing the camera at various locations in the room and zooming it in on particular people. We indicated that Mrs. A would have to show them how to operate the remainder of the equipment when it was reconnected. Mrs. A gave an overview of the course and the mechanics of material distribution. The students were asked if they have any questions about the course or if they had concerns about this mode of instruction. No concerns or issues were raised but the students expressed a sense of excitement about taking a course in this format and expressed thankfulness for not having to take this course by correspondence. Having a teacher to work with them, albeit at a distance, was highly preferred. Towards the end of this discussion one student asked about extra help if it were needed. "Where do we go for extra help?" "How do we get a hold of you

outside of class?" Suggestions of extra help sessions by videoconference and email correspondence were made and the instructor decided to determine the form the assistance would take when the need arose. I could not help but hope that the sense of excitement and opportunity could be maintained throughout this course.

I informed the students about the nature of my research project. They seemed eager to participate and agreed to let me be a part of their class on a regular basis. One student commented on how nice it was to be able to have input into shaping this mode of delivery.

The session ended with everyone looking forward to meeting again. The students were off for the day and I talked with Mrs. A about the things I had hoped to do with the students but couldn't due to the equipment being disconnected. She agreeed to go over the use of the other peripherals with the students on the first day of class. We had not accomplished all that we had hoped to but an initial contact was made and all participants seemed eager and ready to start.

The technician returned to the room at the remote site to work on the projection system. The belt had been cinched up an extra notch. I thought I had just witnessed the first technologically induced lunar eclipse. We may not have accomplished all that we had planned but we

did make one small room in the remote school a more pleasant place to be. I made a mental note to look for collateral learning. What would be accomplish besides the instruction of some mathematical concepts?

Post-class Reflections

The first meeting may not have been what we had hoped it would be but the initial contact was made and hopefully it would get the students thinking about what it would be like to take a course in this format. The novelty of this form of delivery seems to have created an initial excitement and commitment to this course. I wondered whether this excitement and commitment shown towards the technology could be sustained and transferred to the content of the course. From a social constructivist view, the fact that these students seemed to be very comfortable with each other was a good sign. The small school environment may have promoted the social interaction that created this level of comfort. It would be interesting to see whether that comfort translated into mutual support for learning in this course setting.

The initial lack of questions or concerns on the part of the students took me by surprise. Perhaps the students had not given this course much thought yet. They were in the process of wrapping up the first semester and this course would not begin for a week or so. Perhaps the focus was on the technology and the novelty of watching

themselves on 'television' or perhaps there was a reluctance to open up to two strangers who came to visit electronically. The question of additional personal help that arose towards the end of the meeting hit on a topic that recognizes the difference between providing information and the creation of knowledge. "How are you going to help me when you are not here?" This may also speak to the history that the students brought to the setting. Personal help may have been a significant factor in their academic success to this point and a need that they foresaw in this setting. It is obvious that the initial meeting created more questions to pursue. I looked forward to meeting with the students in the not too distant future and gathering their initial perceptions.

Events of February 4, 2004

Spoke with Mrs. A on the phone today. The class was off to a rocky start. Inexperience, on the part of both the students and the instructor, in operating the videoconference equipment had been overcome but at the expense of a bit of instructional time. The students at the remote school had an assembly one afternoon that took them out of class and the power had gone off at the remote school one day. This was followed by a four-day weekend for the students as the teachers went off to teachers' convention. Very little was accomplished in the first week but hopefully this first week had established a foundation to build on.

Events of February 19, 2004

Last week I observed one class session by videoconference. Mrs. A was using an open outline format for instruction. A three or four page outline of the material to be covered in a given class was faxed to the videoconference suite on a daily basis. The students at the remote site made copies for each student at the remote site on the multi-function printer and distributed them before daily instruction began. The open outline was a summary of the key points to be covered during the class along with examples to be worked through during the lesson. Space was provided on the sheets for student work. This was followed by more problems to be completed independently and referenced to textbook examples and assignments. The open outlines were intended not only to provide structure to the daily class but also to structure the students' note taking. These daily open outlines were supplemented by weekly assignment sets that were to be completed and faxed back to the teacher.

In the observed class the lecture approach was used. The first student into the room at the remote site checked the printer for the day's outline then made and distributed copies to the other students as they entered the room. Attention was focused on Mrs. A as she went over the material for the day. The students at the host site interjected

comments and questions but there was no dialogue with the students at the remote site. It appeared that the instructor did not know the names of the remote site students. Mrs. A occasionally asked the remote site students if they had any concerns but there were no questions asked. At 3:10 PM the students registered in the senior physical education course asked to be excused and left the room. The lecture continued until the end of the class period with no time set aside for the students to work independently nor were there any directions as to what was to be completed for the next day.

At this early stage of the course the interactive whiteboard had not been activated. Instruction was provided using the document camera. The students at the host site could see the students at the remote site for the duration of the class but the students at the remote site could see only Mrs. A for the first few minutes and then the output from the document camera for the duration of the period. They could hear the questions and comments of the students at the host site but they could not see them. The students at the remote site focused on the print material received that class. Not only was there no interaction between the instructor and students at the remote site but also there was little interaction amongst the students at the remote site.

The interaction between the teacher and students at the host site indicated a level of familiarity that had developed over the years that these participants had worked together. The lack of interaction with the students at the remote site may have been a result of them actually knowing the material and not having any questions. It may have been a lack of comfort with the instructor (or perhaps the introduction of an observer who had not been present before). Hopefully today's visit would clarify the situation.

Today was the first of four planned monthly visits to the classroom. It also happened to be the day that one of the school division's technicians was sent to the remote site school to show the instructor and the students how to connect and use the interactive white board. I had sent an email message to the instructor and the students informing them of our visit. The technician was in the videoconference suite testing the equipment when I arrived. We discussed the different ways in which this addition to the instructional tools could be used and I suggested that, instead of showing the students how to set it up, that he talk the students through making the connection. They were the ones who were going to be responsible for doing it so the thought was that the sooner they get their hands on the equipment, the sooner they would become comfortable with its use. Mrs. A connected from the host site and seems rather surprised to see us there. She had forgotten

that we were coming today and had planed a test for this period. Plans were quickly changed and she seemed eager to get to use the white board.

Students entered the room and introduced themselves to the technician and myself. I was impressed by the cordial reception we received. Hands were shaken and we were welcomed to their school with comments like; "It is good to finally meet you." Students joined the instructor at the host site and all seemed excited about learning how to operate the interactive white board. I'm not sure if the excitement was due to learning something new or the postponement of the test. The technician had the students at each site gather around the computer terminal and began to describe the way in which the white board operated. The students turned on the projection system and those at the host site created an interactive conference while those at the remote site joined the conference. Mrs. A brought up a word-processed document and the technician explained how the pens at each site could be used to highlight or write over the document. Students at each end were writing and drawing pictures on the whiteboard and commented on each other's artistic ability. This was probably the first social interaction that had taken place in this class. The technician talked the students through how to shut down the white board conference and then asked them to bring it back up again on their own. This was done

without any problem and the students were back drawing pictures on the board.

Mrs. A soon organized the students and gave an overview of the next lesson. The open outline was brought up on the white board and she began to write in the open spaces. The students had not received a print copy of the outline and were frantically trying to copy the information off the white board. Students at both sites were asked to come up to the board and enter the next step in the solution of a problem. Near the end of the class the students were reminded of the test, which would be given tomorrow. Class was dismissed but a number of students lingered to write on the white board. The technician insured that the conference was closed and that the projection system was turned off at the end of the session. Before the remote site students left, I asked if it would be possible to meet with them individually sometime the next day. An interview schedule was drawn up and the students departed. Mrs. A, the technician, and myself discussed how the course was going and the ways in which the interactive white board could be used. I was pleased with the speed with which the students caught on to the use of the white board and the willingness to participate in its use.

Initial Interview Results

In this initial round of interviews I wanted to get the students' initial perceptions of the videoconference experience. What were their expectations before they entered the course? What were their reactions to the course now that they were 10 days into it? I also wanted to gather some background information on the way that each student approached the learning situation, where they would go for help if needed, and any changes they felt they needed to make or could be made to the delivery of this course in order to succeed in this course. Students were also asked to identify any positive and negative aspects of their experience to this point. The intention was to draw out of the students their initial perceptions of the experience and to highlight those issues that were of importance to them.

When questioned about initial thoughts on taking a course in this format the responses were mixed. Some focused on the technology. Cindy commented that, "...this is going to be really cool. It is like watching a movie....we don't usually get to watch many movies in math." Mark stated that, "This is an interesting way of doing a course with all of this technology here. It is going to be interesting to see how it works out." Gary, the one student who had previous experience with videoconference instruction, referred to the opportunity this provided:

> I did the [CTS module] here last semester and it worked out ok. I hope this course works out as well

> because it is one I need for my university program next year. The timing [of the delivery] of this course is great.

Mary, while pleased with the opportunity that the delivery of this course provided, tempered her excitement with some self-doubt:

> I'm excited about having a chance to take this course but I'm a little worried. I'm nervous...not having a teacher here is weird. I'm not a strong math student and I need someone here to make sure I do the work.

It may not be surprising that the initial perceptions were focused on the technology. Attention was directed to the change in the instructional setting and not necessarily on the content of the course. All of the students interviewed saw this course as an opportunity that they would not have had otherwise. The option of taking this course by correspondence was not one that any of the group would have pursued. All entered the course with a positive mind set looking forward to seeing how the technology worked and pleased with the chance of getting a course that had never been offered in their school prior to this point.

An Interesting Change in Perception!

What a difference ten days can make! All of the students interviewed were eager to talk with me-not to sing the praises of increased opportunity or the wonders of modern technology but to express their frustration in what had happened to this point. Bob

focused on the technical glitches that had hampered progress in the first few days and the effect it had on him:

> The first few days were awful! We disconnected the session one day when we were trying to switch to the document camera. When Mrs. A reconnected us we could not hear them and they could not hear us. We sorted it out but these sorts of things make me frustrated and I can't get much out of the class after that.

The minus 43-degree weather that prohibited the personal visit and the training session for the students in the use of the system had taken its toll. While we had conducted a number of training sessions for the instructor on the use of the technology and designing instruction for this mode of delivery, it became obvious that similar instruction needed to be provided to the students. Gary indicated that:

> …things are getting better. We are learning how to use the equipment and there aren't as many screw-ups as there were earlier. What we need is a list of trouble shooting ideas. What do we do when things don't work.

A trouble-shooting guide was compiled by the technicians and posted in each suite soon after this visit.

Dissatisfaction was also expressed for the way in which the course was being taught. Cindy was the most vocal in expressing her dissatisfaction. When asked what her impressions of the course were now that she was 10 days into it she said:

> BORING! We are going so slow and there are days when we do nothing at all. Mrs. A does not give us directions as to what has to be done so we finish the

> sheets for that day. When we come back the next day the [host site students] haven't finished the sheets so class time is spent going over what we finished yesterday. We just sit here and do nothing.

Mark echoed her comments by saying:

> [The host site students] know Mrs. A better than we do. They probably know what she expects without saying it. We don't know her very well and don't know what she expects. It would be nice if she gave clearer directions for homework.

Differences in school culture, teaching styles, perceived differences in levels of ability and background were also expressed. Comparisons to their previous math teacher and her instructional style were made. Bob mentioned that:

> ...they seem to take a lot longer to finish their work that we do. It would be nice if we were all working at the same rate. It would make things run smoother.

Mark commented that, "...maybe the [host site students] haven't finished Math 30 yet. Some of the things they ask are things they should know from Math 30." Cindy said:

> We have a great math teacher here. [She] tells us what we need to know and gives us time in class to work on questions. We learn the stuff by doing it not listening to someone else do it. Mrs. A just talks for the whole period and doesn't give us time to work. She needs to be quiet and let us work.

Mary, Bob, and Gary also commented on the different teaching style but indicated they were 'starting to adapt to it' and Bob said, "You soon learn what to listen to and what to ignore." It was obvious that the

change in teaching style was a hurdle to overcome. The students at the remote site had taken all of their math courses from the same instructor since Grade 9. Her teaching style was very organized and, in the minds of her students, she was very demanding. This style was not just the one that they had become accustomed to but one that was ingrained in their minds as the way mathematics was to be taught. Making the change at this point in their schooling was difficult. The success they had experienced in previous math courses seemed to be in jeopardy. It should be noted that a similar change in instructor in a face-to-face setting would have created a similar reaction. The opposite was true at the host site. The students in that school had been students of Mrs. A for a number of years and knew what the expectations were in that setting.

While the majority of the students focused their concerns on external factors like the use of the technology, the teaching style of the teacher, and the way in which the class was being run, Mary focused on herself:

> I've got to know the teacher a little bit so it is becoming a little more personal. I really have to force myself to get the work done. [Former math teacher] used to force us to do the work. Here, if I don't do the work, no one sees that it isn't done. You have to be very self motivated here. Not having the teacher here may catch up with me somewhere in the future. I'm holding my own now...

When asked where they would turn for assistance if they had difficulties working on a problem, the majority indicated that they would do as much as they could on their own then ask a friend in the class, and finally if they could not work it out amongst themselves they would ask the teacher. There were two exceptions to this. Mary indicated that the teacher would be the first source of help, followed by friends in class. John stated that, "I do what I can and if I can't finish the problem I leave it. The teacher usually goes over the questions the next day anyway. Any I can't do get filled in then." Gary had indicated that he usually asks his friends first if he has a problem but added that most of the friends he associated with were not in this course. He did comment that Mrs. A was very good at answering questions.

Mary commented that one of the biggest changes she had made was to rely more on her fellow students for help:

> I have to rely more on my friends than I used to. They have had the same teachers as I had in the past and they can explain things to me in the way that we have been taught…but it still would be nice to have the teacher here or at least a teacher aide that knows the math.

Asking the teacher for help was a last resort for the students at the remote site not only because they were accustomed to working out problems amongst themselves but also because it was hard to do in this setting. Bob indicated that, "…you don't want to interrupt Mrs. A

while she is talking and with the time delay in the video conference it is hard to find times when you can ask a question." The couple of seconds between the time the speaker finishes talking and the students at the remote site hear the end of the message is caused by the relatively slow rate of transmission and creates, what the teacher may perceive as, uncomfortable delays in communication. The instructor interpreted these seemingly long periods of silence as there being no questions and continued with the lesson. The nature of the course also added problems in asking questions. Cindy said:

> It is hard to describe where the problem is. If I know where it was I'd fix it. We don't have the teacher looking over our shoulder and pointing out where the problem is and it is hard to describe when there are many steps in the solution.

When I suggested she use the document camera to show the work to Mrs. A she replied:

> If it were only the students here that were seeing my work I might do that but all the students in [the host site] are looking at my mistakes on their TV. I don't know them and I don't want to show them my mistakes. It would be much easier if there was a teacher here to point out where things went wrong.

While the technology provides a solution to the problem, the use of that solution is hampered by the lack of trust between the students at each site. Not knowing how the other students would react prevented this student, and perhaps others, from gaining the full advantage of the teacher's presence.

Mark did not seemed troubled by the barriers that others saw in asking for help:

> It is hard to describe where the problem is but Mrs. A is really good at answering questions. If we have a problem she usually goes through the question from start to finish. This is much better than doing this by correspondence. If anyone has a question they can ask. We have access to the teacher…

The difference in comfort levels in asking for assistance should not be a surprise. In a traditional setting, students have varying comfort levels in asking for help but the separation of teacher and students and the lack of familiarity with a portion of the class does throw additional barriers in the way. This was emphasized by the ease with which the students at the host site related to the teacher.

One component of the instruction that all of the students were pleased with was the print material that Mrs. A provided on a daily basis. This open outline contained the key points to be covered in that day's class along with a number of examples that were to be worked through to illustrate and reinforce the concepts covered. Mrs. A usually worked through all of the examples, prompting the students for input, and checking to see if everyone agreed with the answer. This provided the option for students to work ahead and provided a check for their work. Mary commented that, "…when there is something in front of us it is easier than just listening and taking notes…it helps to set the

material in my mind. These pages tell us what the important stuff is." Mark, who seemed to always be working ahead of the others, stated that, "...the pages are pretty much self explanatory. It gives us something to work on while she is teaching the other class. We only need the teacher to answer questions when we run into problems." Gary added that, "The pages that Mrs. A sends us every day make good notes. It tells us what is important...I just hope the tests are based on these notes."

Marks' comment above about giving, "us something to do while she teaches the other class" reflected the perception among all of the students at the remote site that they were separate from the students and teacher at the host site. This separation was not just a sense of geographical distance but also a separation in abilities. Cindy expressed sympathy for the teacher in having to deal with people of varying abilities:

> She should help the other class if they need it and just let us work. The levels are different between our school and them. If this is going to work smooth you are going to have to find students of the same level.

This sense of separation was noted by other students who used terms like 'second class students' to describe themselves and made comments along the lines of, "They have the teacher and all we have is the TV." Mary observed that it was, "...more private for them. They have the teacher right there. We're more on public display and if we need the

teacher we have to interrupt their class." At this point in the course there was a very strong perception of difference. The terms 'them' and 'us' were used to describe the experience to this point. The term 'we' was not used to describe the entire class by any of the participants during this first round of interviews. The perceived differences in abilities and the perceived differences in access to instructional assistance were instrumental in building this sense of separation.

The students at the remote site had mixed feelings about the classroom atmosphere that was developing. On one hand they enjoyed the physical absence of the teacher but on the other hand they commented on the occasional frustration that the absence created. Bob indicated that, "We are a little more independent here without the teacher. It's a more relaxed setting and we get to work at our own pace … but sometimes it's frustrating not having the help." Gary echoed his comments by saying it is "more comfortable here" but noted that that level of comfort only came after their proficiency in the use of the technology improved. Mary commented on the fact that, "We are all friends here and that makes it more relaxed. We are all here together and that makes it more casual than a regular class."

Adaptations to changes in teaching style and the instructional setting forced changes in learning styles. Students commented on how

they had to change the way in which they worked in class and the challenges that these changes introduced. Mary indicated that:

> I have to be more self-motivated here. I'm used to having the teacher help me through the course. Now I have to rely more on my friends in the class. It is scary but it is good. This is something I will have to work on.

Gary, Mark, Bob, and John indicated that this was a more 'independent' style of learning and they expressed the thought that this was a good preparation for the way they were going to be expected to operate next year in university.

Gary stated that he had to "listen more" than he did in a regular class:

> Our teacher here (local teacher) used to write the questions on the board and point out the important words and information. I liked that. Here we get the papers every day and it is just like trying to read the textbook. We work through the questions but I have a hard time reading through the questions to know what to do. I need to hear and see the work.

Mary made similar comments indicating that she had to "focus more":

> I have to listen and watch more carefully. Everything is happening on the TV…you have to focus more on one spot. There are less distractions here than in a regular class but everything is coming from one TV and not from the whole class.

Adaptations had to be made not only to the teaching style of the instructor but also to the medium that was delivering the instruction. Gary held out hope that the instructional style would change in the future, "Mrs. A doesn't know us. When she comes down here maybe

she will see that we learn in different ways and she will change to meet the ways we learn."

When asked about the role the students at the host site played in the math course a variety of responses emerged. Bob and Mark indicated that getting to know the students at the other site would be nice but not essential for success in this course. Bob said:

> We don't interact with the students at [the host site]. We rarely even see them on the screen. It doesn't matter. The course is what is important and we need Mrs. A more than we need to know the students there.

Marks' comments reflected a similar thought, "...we don't need them to do this course. It might be different if it were another course that needed a lot of discussion but we are here to do math not socialize." Mary and Cindy expressed concerns about feeling uncomfortable asking questions when they did not know the students at the host site. This was especially true when they had worked through a problem and did not get the correct answer. Both were hesitant to ask Mrs. A to go over a question and in all cases asked local students for assistance.

There was an indication that getting to know the teacher was more important than getting to know the students at the other site. Mark indicated that the students got to know the teachers in their school on a 'personal' basis because they interacted outside of school and,

"you get to know what they do besides teach. It helps to make it easy to talk to them." Gary summarized a similar response by saying:

> I want to get to see Mrs. A through the machine rather than just seeing her on the TV. It is harder to talk to a machine that it is to a person. Right now we are talking to a machine.

The issue of time or the use of class time was also commented on by the majority of the students. There was dissatisfaction expressed by the students at the fact that the teacher seemed to be talking all the time and not providing time for the students to work. They also felt that there was a lack of direction as to what work had to be completed by what point in time. To compound this problem, three of the student left early every day for their physical education course. There was little direction given to them as to what had to be completed for next class. John commented that, "We thought by that point in the class we would just be working and wouldn't miss much. She is still teaching when we have to leave." It was clear that the instruction needed to be structured than it was at that point.

Post-Interview Reflection

By the end of the first round of interviews it was clear that the initial enthusiasm for the course had been tempered by the reality of the experience. In the students' minds the technology had proved to be an obstacle to be overcome. In addition to learning the content of the

course they had to learn how to operate the videoconference system. The need for more structure in the instruction and clarity in expressing class expectations was evident. No doubt this was going to be a learning experience for not only the students but the teacher as well. Finally, I was slightly surprised by the role that the students' previous experience has played in setting the expectations for this course. Also rather surprising was the resistance to change on the part of some participants. Some looked at this as a situation where they could grow and change while others demanded the external factors change to meet their leaning needs and styles.

Upon completion of each interview, I asked the students what they would like me to relay to Mrs. A. I assured them of anonymity and indicated that their requests would be expressed on behalf of the entire class. They had asked that time be provided in each class for them to work and that answers be provided so that they could check their work. They also asked that she come to their site and teach from there thus giving them a chance to get to meet her. The final request was that she clarify, on a daily basis, what was expected for the next class. These requests were relayed to the instructor upon the completion of my visit to the remote site.

Following the round of interviews, I sat in on the class at the end of the day. The test, which had been postponed from the previous day, was administered. The test had been emailed to the principal of the school who ran off sufficient copies for the class. I supervised the exam and found that the students at the remote site did complete the exam well before the students at the host site finished. Each student faxed his or her exam to Mrs. A before the end of the class period and was permitted to leave once they had submitted their exam.

Events of March 22, 2004

In the month that has passed the concerns of the remote site students have been addressed. Mrs. A has made one trip to the remote site and taught the course from there. In the classes I've observed, time has been provided for class work and more direction is given as to the work to be completed for next class. From a distance, things seemed to be flowing more smoothly and there was more dialogue between the teacher and the students at the remote site. Unfortunately, Mary and Gary had dropped the course. They had informed me of their decision by email and agreed to meet me and discuss the reasons for their decisions.

I sat in on the class and my observations confirmed what I had seen from a distance. The atmosphere was much more relaxed and

there was considerably more dialogue between the teacher and the remote site students. The students at the remote site worked together more than they had on the last visit. They consulted each other as they were working through the material and compared answers to the assigned problems. I sat beside John and he turned to me to ask questions about the material that seemed unclear to him. I also spent some time circulating around the room helping where needed. The group seemed more than willing to ask questions and seemed to appreciate the support. This was a much different group than the one I had met a month ago. A routine had been established for the start and end of each class. The first student into the room checked the multi-function printer for the day's handout and copied enough for all the students. The second student in the room turned on the projection system for the interactive white board while a third was assigned the job of shutting it down at the end of the class. I also noted that the students at the host site were the ones to initiate the videoconference session and to turn on the projection system and to initiate the white board conference. This was completed before the instructor arrived in the classroom. It was good to see that the use of the technology had become second nature and that a routine had been established for making the required connections. Comments were made that it was nice to be able to operate the equipment without giving it much thought so that they could focus on their course work.

The interactive white board had become the primary vehicle of instruction. It had replaced the use of the document camera for all instruction except situations where the instructor wanted to display the screen of the graphing calculator. The students at the remote site did not use their document camera at all. They still did not feel comfortable showing their work to the students at the host site. The interactive nature of the whiteboard was employed by asking a student at the host site to write the first step in the solution of a problem and then asking a student at the remote site to write the next step and back to the host site for the next step. The students enjoyed this diversion from seatwork but commented that it slowed things down during the class. The larger screen display and the ability to see both the instructor and the screen were perceived to be a great improvement over the use of the document camera. At the end of the class, a schedule was made for the second round of interviews the next day. The two students who had dropped the course earlier saw me prior to the class and arranged times to meet and discuss their experiences.

Gary

Gary dropped the course just before the teacher had made her first site visit. At our first interview and during subsequent email conversations he had indicated repeatedly that his style of learning did

not match that of this course. He had completed the CTS module in a videoconference format and had enjoyed that course. He mentioned that the CTS module was "not too hard" but the math course "was tough". The nature of the course content and the duration of the course dictated his success or failure in this form of delivery, "This [video conference delivery] works well for short easy courses but is really difficult for a full academic course like this." Gary stated that he worked well in a setting where the information was presented in an oral and visual format, where the problems and solutions were presented in a step-by-step process rather than displayed as a whole. He found the material provided on the daily handouts to be similar to reading a textbook and presented in blocks of information that were difficult to comprehend, "There was no one here to guide us through the material. I need to see and hear the explanation of the problem rather than getting it dumped on us in one shot."

He also questioned his level of involvement in the class:

> …going from a classroom to a TV is a pretty drastic change. This was like watching TV where you just sit back and let it happen. This just wasn't cutting it for me. I need to be involved with the teacher and the math to make it work for me.

The presence of the technology induced an observational mindset that was hard to over come. The combination of the absence of the teacher

and the nature of the course were brought up repeatedly in our conversation:

> We couldn't ask the teacher to come over and look over our shoulder and tell us where the problem is. There are many steps in a math problem and I can't describe what I've done without showing someone my work. The teacher wasn't here and you had to rely more on yourself or ask your friends in the class. I couldn't do that.

Gary also commented on the fact that the rest of the students in the class at the remote site seemed to be catching on and he did not want to continually "bug them for help".

When asked what could be done to improve the delivery of this course in this format, Gary focused on the role of the teacher:

> It would be good to have the teacher come out before the course begins to meet the class. That way we would get to 'see' the teacher and get to know her personality. It might make it easier to talk to her then. It would be good if she came more than once a month or if there were a teacher aide that you could go to for help. Maybe an extra class where we could ask questions and not cover new stuff would help.

The shift from a teacher centred environment, or at least one where the teacher is present, to one that relied more on self-initiative was one that Gary found difficult. It may be possible to overcome some of the deficiencies noted by Gary in this mode of instruction by designing instruction to match a wider variety of learning styles. This, in turn,

would require the teacher to be more familiar with the students earlier on in the course.

Mary

Mary had dropped the course a week or so before this visit to the remote site. She had indicated earlier that she "was not a strong math student" and that she relied very heavily on help from her teachers in every course. Mary remained positive indicating that this had been a "good experience" and had nothing but good comments on her fellow classmates who had helped her and studied with her in the first month and a half. She also praised the teacher who had to adapt to a new form of instruction and who had taken the time to come to the remote site to meet them.

The lack of physical presence of the teacher was identified as the primary reason for dropping the course. Mary indicated that:

> This was a good experience but I'm not very good at teaching myself stuff. I had to ask the other students stuff that I would normally ask the teacher. They were struggling with the math too and couldn't explain it to me like a teacher could. I just couldn't learn that way. Nothing was clicking.

She repeated her comment of a month ago stating that, "It would be good if Mrs. A would come here more often or if we had a teacher aide or someone we could go to for help."

Mary noted that a number of the students in the class had adapted to this form of instruction and were experiencing success but she indicated that she found that "changing was a real stretch for me". She perceived that in order to succeed you had to "work really hard on your own" and that you needed "a lot of personal direction". Her comments seemed to indicate that she viewed learning as an individual activity with the assistance of an instructor. The presence of the other students and those at the host site did not play a very large role in the learning activity. The fact that there was no teacher to go to outside of class time for assistance was a barrier that Mary was unable to overcome.

In subsequent email correspondence, Mary indicated that she had given her videoconference experience considerable thought. Mary futher indicated that she planned to pursue a career in education. She was rather distressed in that she viewed the development of independence in the learner as a desirable goal, "How can I expect or teach my students to learn independently when I can't do it myself?" Her inability to adapt to a new form of instruction and her increased awareness of her dependence on the teacher had caused her to question her choice of career. After a number of email messages discussing different learning styles and preferences, Mary seemed to have regained her confidence in her decision to enter education. I can't help but think

that there was a considerable amount of learning that occurred, not only on the part of the students that completed the course but also in those that withdrew before the completion of the course.

Comments from Remaining Students

The remaining four students seemed to be more actively involved in the course at this point. The first visit had occurred ten days into the course and the group had experienced a number of technical glitches and were faced with learning the operation of the technology, learning the content of a new course, and dealing with adapting to a different teaching style. The students at the remote site seemed rather stressed at the initial meeting and were very vocal in expressing their frustration in dealing with change. Over the past month their competence and confidence in operating the technology had increased. Also, the teacher had made a visit to the remote site and had taught the course from that site. The students were given a chance to get to know the instructor and had an opportunity to voice their concerns related to the delivery of this course. The students had also viewed the introduction of the interactive white board as an improvement. It had increased the amount of interaction between the students and the teacher as well as between the students at each site.

In each of the personal interviews the remaining students were asked what had changed since the last time I had spoken to them. They were also asked to identify anything that had not changed. We also pursued any individual issues or comments that had been made in the previous interviews.

The students had achieved a comfort level with the use of the technology that allowed them to focus their attention on the course material. Bob stated that:

> We know how to use the technology now and we know our options and can pick the tool that is going to solve the problem. If the [interactive white board] goes blue I know it is the screen saver that has kicked in. Things like that really frustrated me but now we know how to handle them.

Other students' comments and observations over the past month reflected a similar comfort with the use of the technology. The students mastered what initially appeared to be a rather steep learning curve very quickly and a routine for start up and shut down at the end of class was quickly developed.

Earlier this month Mrs. A had made a trip to the remote site and had taught the class from there. The majority of the students had enjoyed her visit and had indicated that the atmosphere in the class had changed since that visit. John stated that, " Mrs. A talks with us more since she was here. She asks us how things are going and what works

best for us in the class. She got to know us a bit and our differences."

Bob commented that:

> We got to know her as a person when she was here. She got to know us better and can identify with us. She knows what we can and cannot do and she knows who to pressure and who to let up on. It has made the class a lot more comfortable… It would have been better to have her down here earlier.

Mark said, "We got to know her sense of humour and can joke with her more now. Things have got much better since she was here." Cindy was the only student that indicated that nothing had changed as a result of Mrs. A's visit:

> [Since her visit] there hasn't been any change. When she was here we were able to ask her questions but after she left things are back to the way they were before. We asked her to pick up the pace but she still talks for most of the class. Nothing has changed.

While changes had been made not all of the students recognized them. All of the students, however, did comment on getting to see the entire class at the host site on the day when Mrs. A taught from the remote site. They indicated that this was a chance for the host site students to feel what it was like to not have the teacher. The sense of separation between the students at the two sites was still evident. There was still a feeling, among the remote site students, of being disadvantaged. All students commented that on the day that Mrs. A taught from their location the students at the host site did not contribute much to the dialogue.

With the technology glitches sorted out there were still some concerns related to the way in which the course was being taught. While Cindy asked that the pace be increased and that more class time be spent working on assigned questions instead of lecture, John indicated that he was getting behind and that he would need to do more work at home. John also recognized that, "this is working well for the other students who are keeping up." Bob commented that both the students and the teacher had changed over the past month, "We are getting more time in class to work on problems now which is good. We feel more comfortable asking questions and things are much better now." Both Cindy and Bob commented on the fact that there were fewer students in the class at the remote site and that, "Mrs. A has more time for each of us now."

In addition to the use of class time, another concern related to the nature of the instruction was expressed by all of the students except Bob. The students indicated that they were being taught how to solve problems but that there were no connections being made to previous math instruction and no indication as to why they were being taught these processes. The students did not see how the content of this course was connected to their prior learning or where it was heading in the future. The nature of the Math 31 course may have contributed to this concern. The course began with instruction in a number of algebraic

and geometric skills that were then applied to a variety of situations in the latter part of the course. This lack of connection and direction was expressed in a variety of ways. John expressed concern by saying:

> … things work well when we know the basics and have to tools to work with. We don't get any notes here. All we do is go over examples and answer questions. I don't know where the rules come from… More teaching is required – more explaining.

Cindy expressed similar concerns by stating:

> This course is different than other math courses. It is not the problem of the teacher but I don't know where this math course is going. We are just doing problems that follow the pattern she taught us.

Mark described solving a particular type of problem by saying, "I know at this point I have to drop this term. If I forget to do that it doesn't work out. I don't know why it disappears but I have to remember to do it."

These comments had confirmed concerns that had developed in my mind based on a number of classroom observations. There had been very little provided as far as an overview of the course and no development of the fundamental rules used in the calculus course. The rules had simply been given as fact and time had been spent applying the rules in a stepwise manner with emphasis placed on obtaining the correct answer, which could be verified by use of the graphing calculator. This request for more explanation for the origins and direction of the course would have to be weighed against the request for

more time to work on problems. Hopefully a balance could be achieved.

Feeling comfortable in asking the teacher for assistance was still an issue for two of the students. Both Cindy and John had indicated that they needed "just a little help" and that they viewed the problems they were having as "minor problems" or "little questions". Both felt they had a fair grasp of the material but missed having the teacher present to look over their shoulders and locate the problem. In their minds, the difficulties they had were minor in nature and not worth interrupting the teacher to solve. John did not feel comfortable in asking any of the other students in the class for assistance while Cindy had spent a lot of time working with Mary but felt alone again now that Mary had dropped the class. Cindy had worked more with Bob and Mark in the past few classes and was feeling a little more comfortable in the assistance she was receiving from them. The comfort level amongst the students at the remote site appeared to be a factor that contributed to success and persistence of the students involved. Similarly, the comfort level between the students and the teacher seemed to contribute to the willingness of the students to communicate concerns to the instructor. John and Cindy did not hesitate to ask me questions when I visited their class but did not feel comfortable asking the instructor. Small problems or minor concerns could be straightened

out in one-on-one personal conversations but were not deemed worth interrupting the entire class over. On the other hand neither Bob nor Mark had any reservations about speaking up and asking Mrs. A to clarify a point or to ask for assistance in going over specific problems. Personal differences in confidence levels, perceptions of the relationship with the instructor, and basic social nature of the individual students seemed to contribute to varying degrees of interaction with the instructor.

The question of personal change and adaptation came up in the interviews with each student. A wide range of responses were received when asked about the changes that had occurred in the strategies used to function in this class. John indicated that there was no difference between what he did in this class and other classes he was enrolled in while others identified a shift to a more independent style of learning and yet others indicated a more collaborative learning environment within the confines of the remote site. Bob identified this type of instruction made him "a more independent learner". He followed this by saying, "I need to work harder to figure out my own mistakes here than I would in a regular class. I can learn better if I can figure out what I've done wrong." In comparison, Mark indicated that:

> ...if I have a problem I can just ask the other students here. If we compare our work we can find our mistakes and help each other get through the problems. We rely on each other more than we would in a regular class

> because the teacher is not here but if we are all stumped we still have the teacher we can ask.

Cindy, who had expressed concerns about the difference in teaching style and who had worked very closely with Mary until she dropped the course and who now relied on Bob and Mark for assistance did not perceive a significant change in learning strategies used. While, from observation, she seemed to be the student that had experienced a significant change she did not personally think that she had changed sufficiently to be comfortable in this type of instruction. This was reflected in her comment, "If the teaching style was the same as what I was used to then I would do much better. I know I should be able to change but it is hard." She had perceived the other students adapting to the instruction and did not feel that she had adapted to the same degree. Cindy set a very high standard for herself and any hint of not attaining that standard was perceived as failure.

Post-Interview Reflection

The issue of the relationship between the students at the remote site and the host site that was raised during the first round of interviews did not come up spontaneously in this round of conversations. When pressed about the issue the students indicated that there was a desire at the beginning to get to know the students at the host site but that the nature of the instruction did not lend itself to that happening. There was still a definite sense of separation, a competitive sense of 'us versus

them' with the students at the remote site viewing themselves as the disadvantaged group in the class. A comment was made in describing the day that Mrs. A taught from the remote site, that now the students at the host site know what it feels like to not have the teacher. This reflected the feeling that finally the other students were getting a taste of what they had experienced to that point.

By the end of this second round of interviews it was clear that some progress had been made. The issue of operating the technology had been dealt with. All of the students had become familiar with class start up procedures and had become proficient in simple trouble shooting procedures. The cancellation of the students' technical orientation due to inclement weather had created frustrations at the start of the course but the class had quickly established an efficient start up and shut down routine.

The issue of use of class time had been addressed to a degree and the students felt they were more familiar with the teacher and her teaching style. The visit by the teacher to the remote site had helped to develop this level of familiarity. The shift from relying on the teacher to a more collaborative approach with peers had been made by most of the students although there seemed to be reluctance on the part of two of the students to ask the teacher for assistance.

In a face-to-face classroom setting, students that are reluctant to ask for assistance can be approached and aided as needed. In this setting, the instruction must be adapted to determine those in need and identify the type of assistance required, keeping in mind the reasons for the reluctance, on the part of the student, to ask for help. Identification of these reasons may be difficult to do in a distance delivery form like this.

At the end of the first round of interviews, I had asked if there were any issues or comments the students wanted me to relay to the teacher. At that time there were a number of requests as described earlier. I asked the same question at the end of this round of interviews and there were no pressing issues to relay. The students had adapted to the mode of delivery and the instructional style of the teacher. They did not necessarily believe that these were ideally suited to their way of learning but they had adapted and were achieving success in the course.

Events of May 4, 2004

Since the last visit, I received an email from John indicating that he had dropped the Math 31 course. He had fallen behind in all of his courses and needed extra time to catch up on his core courses required for graduation. This course was optional and not a graduation

requirement. He stated that without the teacher present it was impossible for him to get extra help in order to catch up on the material missed. While Mrs. A had indicated that she was willing to provide extra tutorial help outside of class time by videoconference, John did not wish to take advantage of this offer. In his words, "This is not a high priority course for me."

In the observations made over the past month I noted an increased level of communication among the three remaining student at the remote site. The nature of the Math 31 course is such that the second half of the course is application of the procedures developed in the first half of the course. The students seemed to have a more positive attitude towards the material and a more relaxed atmosphere had emerged. Mrs. A provided more work time during class and during these work sessions, the students at both sides of the conference muted the audio so as not to distract the other side. If a question was to be asked or if Mrs. A wished to make a comment or point out information that was pertinent to the solution of a problem, the audio link was activated by the instructor. During the periods while the audio connection was muted the students at the remote site worked on the assigned material, shared their solutions, got up and walked around the room, and engaged in, what appeared to be, light-hearted conversation.

The remaining students at the remote site seemed to have developed a supportive bond that had grown over the duration of this course.

Mrs. A had made a second visit to the remote site just prior to Spring Break. Her comments back to me indicated that she also noted a change in the attitudes of the students at the remote site and that she was more able, at this point, to understand the types of problems each student was having and was able to relate to them better than she had been able to earlier in the course.

In my classroom visitation I noted that the students appeared to be a bit more subdued than I had witnessed over the videoconference link. They had entered the room and routinely started the conference connection. We chatted briefly about their Spring Break activities before class began but the group worked quietly throughout the entire period. My presence appeared to have put a damper on their regular classroom activity. The class progressed well with all students at the remote site completing the assigned work without relying on each other for assistance. All agreed to meet with me the following day.

Interview Comments

The thing that really hit me during this round of interviews was the similarity in the comments from all of the students. I brought this

up before class the following day and all three students said that they talked a lot more about this class than the other classes they were enrolled in. Bob mentioned that after their individual interviews they got together and discuss the questions that I had asked each of them. The students seemed to have developed a group identity and seemed to be developing a common understanding of their shared experience.

The development of a tight support group among the three remaining students was the most noticeable development since the last visit. Mark indicated that, "We get together at the coffee shop to do our math homework or if we have a big assignment we may get together at someone's house. Sometimes we even go beyond the assigned work." Bob noted that they were known around the school as the 'Math 31 Crew', "Sometimes we use the words from our math course in our conversation with our friends, just to annoy them." Bob also mentioned that:

> We can pick up on the fact that someone in the group is having a bad day and respond accordingly. Yesterday I was having a bad day and the other two knew it. That was why it was so quiet in there yesterday. Also, with you being there we behaved as we should when a teacher is around.

Cindy added that, "The three of us were friends before this class but we are better friends now." The shared experience had strengthened their friendship and had assisted in developing a sense of community among the students at the remote site.

The students were quick to note that this sense of community did not include the students at the host site. Mark noted, in reference to their connection with the host site students:

> ...we are separate but together. Together in a loose sort of way. We know they are there but we don't have anything to do with them. We really don't need their help in doing this course. We just need the teacher.

Cindy commented that, "...we need the teacher. I'm sure the students in [the host site] are nice people but we are here to learn math not to make friends. I already have enough friends here." Bob indicated that the students at the host site were like the three students who had dropped the course at the remote site, "We know them but they were not our friends. We don't hang around with them and don't know them really well. We sort of look at the students in [the host site] like that."

The last comment may speak to the group dynamics required for persistence in this type of instruction. The development of a strong local support group may be a factor in success in this setting. Without the presence of a teacher as the supporting, unifying or bonding element in the classroom setting, the students were left to form their own support structures. Mark suggested that there may be more of a bond with students at another site if the teacher did not have students at the host site and that all of the students were at remote sites, "We would all be in the same boat then. No one would have the teacher there and we

would see each other all the time." There was a distinct perception that the students at the host site had an advantage over those at the remote site. Isolating the teacher would be perceived as levelling the playing field for all involved and may contribute to a feeling of shared experience, which in turn, may lead to more communication and interaction between the students.

As this study progressed from the initial round of interviews to the third round, I noticed a dramatic change in the nature of the comments made by the students. The initial interviews focused on the stress imposed by change, the negative aspects of the experience, the shortcomings of the educational experience. The second round of interviews revealed a level of acceptance and a certain level of indifference to the experience. The novelty had worn off but the level of satisfaction was not what it could have been. The current round of interviews was characterized by a more upbeat attitude towards the experience and the comments revolved around the strengthening friendships that had developed and the increased comfort level in the classroom.

Bob indicated that the friendship between the three remaining students had grown over the duration of the course and their relationship with Mrs. A had grown as well, "All three of us are always

joking around. This adds a better atmosphere to the class. We still get our work done but the [absence of the teacher] makes this a more positive experience." Mark supported this by saying, "... we can do things in this room that we could not do if there was a teacher here. We have found a balance between being bored and getting our work done."

It was clear that the freedom from the presence of the teacher had contributed to an atmosphere that allowed the support community to grow. Cindy added that:

> We've gotten to know each other real well. We know where each other is likely to screw up and can help each other with problems. We know where to look. We are doing what a teacher should be doing in the classroom.

During our interviews I mentioned to each of the students that I had noticed a change in attitude towards the experience and asked them what had changed their feelings of apprehension to feelings of satisfaction and what could be done to speed up that shift in attitude. Mark indicated that it was just the passage of time that had facilitated the change, "As people dropped out the annoying behaviours of the others disappeared. As the group got smaller it became more comfortable." Bob added that:

> Mrs. A's visits helped to make the course run a lot better. Getting comfortable with her took some time. Your visits helped too. It made us talk about what was going on and things always seemed to get better after you left.

When asked whether there were actual improvements after my visits or whether the chance to vent their frustrations was sufficient to induce a perception of change, he responded that both were probably correct. When the topic of student support services is discussed in relation to distance education the reference seems to be on providing course specific support to the student. In a secondary school setting a student is not likely to tell a teacher that they are not teaching in a way in which they can learn. The provision of a mechanism by which students can express their concerns and issues dealing with their instruction and have these relayed to the instructor, preserving their anonymity, was important. In addition to assisting the student by directing additional resources in their direction, it seems important that we provide a channel for students to direct their input back to the instructor. This two-way communication is vital in gearing instruction to meet the needs of individual students.

As for steps that should be taken to shorten the time taken to reach an acceptable level of satisfaction, all students indicated that more training, early on, in the use of the technology would be useful. Cindy said:

> As soon as we learned the use of the equipment that was one thing off our minds. We could work more on the course then. We weren't always worried about the thing going off and if it was our fault.

Beyond learning how to operate the technology earlier on in the course, the students were unanimous in stating that the development of the support community is something that "just takes time".

Mark indicated that his perception of the videoconference room had changed over the duration of the course:

> We have become one with the room. We come in here and we each have our place and a job to do to get the system running. We know what happens here and we know how to behave here and it's fun. This is our room. We can leave our books and things here if we don't have homework and we have our problems we've solved up on the board. No one erases them until we put up new problems we're working on. This is our place.

When I, jokingly, commented that this sounds like an animal in the wild marking their territory, Mark agreed but added that, "We don't get that wild in here most days." Over the three months of this course, the impersonal space of the videoconference suite had become a comfortable learning place. The establishment of routines and the shared history that had developed over that short period of time had transformed this student's perception of the classroom. Mark added that, "If I were to take another course this way it would be much easier, not just because I know how to work the equipment but because this is now a classroom where good things happen."

To help the students focus on the changes that had happened over the past few months, I asked each student to construct a graph indicating their change in satisfaction with this course over time. The students were then asked to discuss the changes identified. Mark's graph indicated a slow and steady rise in satisfaction levels.

Course Satisfaction vs. Time Graph

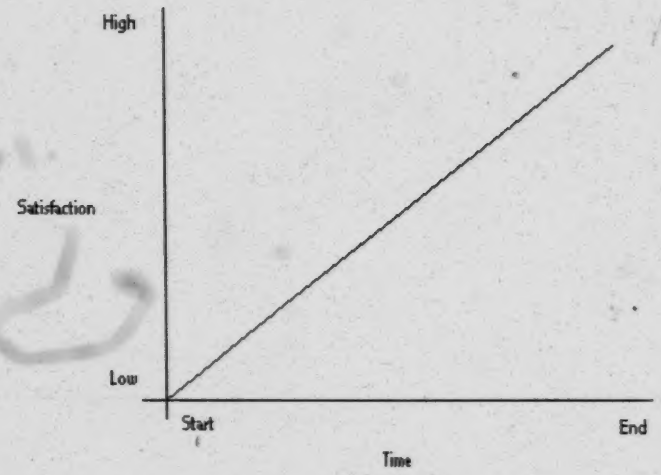

Figure 2: Mark's Level of Satisfaction

Mark was quick to point out that just because he started at the origin did not mean that he was not satisfied with the course at the beginning. He noted that the only other way of obtaining this course was through correspondence and that he would not have taken the course in that format. The start to the course had been a frustrating

experience with learning how to use the technology, adjusting to a different teaching style, and learning subject matter that differed from that of previous math courses. Mark indicated as time went on, they became more proficient in the use of the technology. The use of the interactive white board instead of the document camera made the material more legible and provided another channel of interaction between the teacher and the students. The visits by the teacher to the remote site had helped to create a bond between the students and the teacher. This facilitated more communication and a reduction in the reluctance to ask questions and to talk with the instructor on non-course related topics. Mark also indicated that as time passed and a number of students had dropped the class, the remaining students had developed a friendship that supported each of the remaining participants. This support resulted in increased performance (test scores) for all involved. The passage of time had also given the students a chance to adapt to the teaching style of the instructor. In Mark's opinion this was one of the hardest changes to make. The adaptation and the increasing comfort level with the teaching style, the course content, and the delivery method was something that took time. In Mark's view there was little that could be done to compress the time taken to achieve the current level of satisfaction. In Mark's words, "This has got better as time goes on and I think it will continue to improve as we go on to the end of the course."

Cindy's graph reflected a different view of the videoconference experience.

Course Satisfaction vs. Time Graph

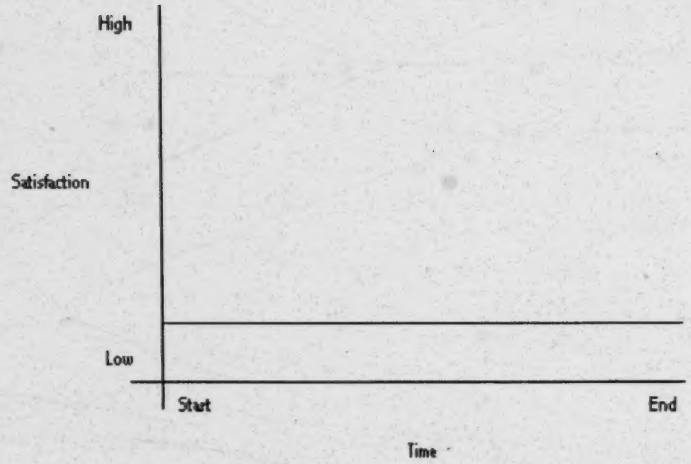

Figure 3: Cindy's Level of Satisfaction

Cindy also indicated that she would not have taken this course if she had to rely upon correspondence delivery but her concerns were focused on the instructional style. All of the students at the remote site had taken their previous math courses from grade nine to twelve from the same instructor. The teaching style exhibited by their local teacher differed from that employed by the videoconference teacher. The adaptation had been a concern expressed by all students but Cindy had been more concerned about adapting than the other students:

> I still don't like the way she teaches. She is talking all the time and things are going so slow. We asked her to pick up the pace but there hasn't been any change. It's just like it was at the beginning. We have to do all the work ourselves. We help each other because we don't have the teacher like the students on the other side.

While the remaining students had made the adjustment to the different teaching style it was still a concern for Cindy. In observations of the class, all students at the remote site had developed an approach to the instruction that involved paying attention to the first explanation of the material provided and then working through the provided material, ignoring the repeated explanations. It should be noted that adjusting to different teaching styles is not unique to videoconference course delivery but also occurs in face-to-face instructional settings. When difficulties were encountered the group tried to solve the problem and, if the group efforts were not successful, one of the boys would ask the teacher. The students at the remote site seemed to be constantly working ahead of the students at the host site. The absence of the teacher was still a concern for Cindy. She indicated that she did not ask the teacher any questions, even when she visited the remote site. Her concern was related to the perceived advantage the host site students had over them with the teacher present. The perceived injustices were at the forefront of her thoughts and these had not changed over time. Cindy did recognize that she was receiving good marks for her work and that she was learning the material presented but the impression

given was that this was being done in spite of the best efforts of the teacher.

Bob indicated a dramatic change in satisfaction that occurred near the mid term point of the course.

Course Satisfaction vs. Time Graph

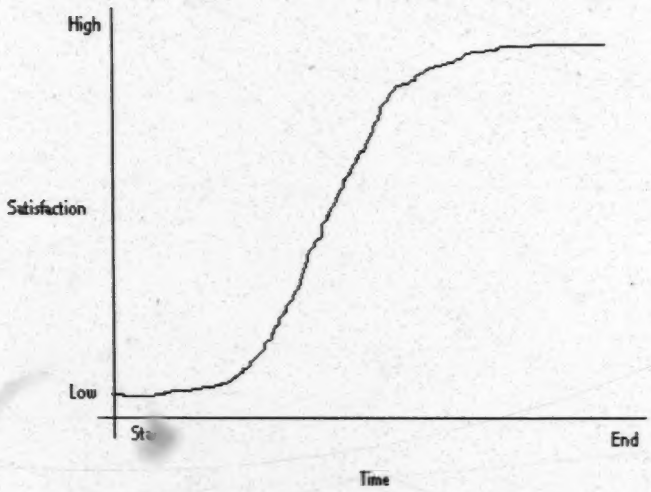

Figure 4: Bob's Level of Satisfaction

Bob indicated that the first few weeks were very stressful, with learning how to operate the new technology, trying to adapt to a different teaching style, and dealing with challenging course material. He indicated that things started to improve as the class got more adept in the use of the technology. The first visit by Mrs. A was the turning point for him. Getting to know the teacher was a critical factor in his

continuation in this course. He indicated he was more willing to ask questions and contribute to the class after meeting the instructor. He stated that:

> ...things started to improve dramatically after [the instructors'] first visit. We started to work together more as a group after that and things became more relaxed from there on. Recently the material seems to be getting easier. At first we were learning new rules and laws one right after the other, now we are applying them and this makes much more sense. We now have a reason for learning all that stuff at the beginning. At this point I'm very satisfied. I don't think it can get any better.

Bob went on to indicate that the development of the friendships with the other two students was a major factor in his level of satisfaction with this course. He indicated that he had wished the development of such a support group had occurred in his other traditional classes.

Post-Interview Reflections

Three different students and three different perceptions of the learning experience. At the end of this round of interviews, I became more aware of the dangers of making generalizations about the learning experience. While each individual was exposed to the same instructional setting, individual differences created unique perceptions of the experience. Each of the students at the remote site had attained an honours standing in the course to this point and their marks were comparable to those at the host site. While there may have been a temptation to indicate, from an outcome perspective, that there was 'no

significant difference' in the experience at the two sites, the attitudes toward the instruction and the means used to attain that level of performance varied dramatically between the sites and between the individuals involved.

Events of June 10, 2004

Over the past month the three students at the remote site have remained in the course and have continued to work together. Mrs. A has provided an increasingly large amount of class time to working on assigned problems. The nature of the course was such that the latter half of the course was primarily applications of the theory introduced in the first half of the course. While the students were working at each of the sites the audio was muted so as the discussions at either end did not disturb the other site. Based on visual observations the students at the remote site engaged in side chatter but continued to complete the assigned material. The relaxed atmosphere at the remote site was evident in the actions of the students as was the comparing of solutions and mutual assistance provided.

This visit occurred a few days before the end of regular scheduled classes. The students appeared tired as they entered the classroom. Mrs. A went over the problems assigned the previous class and assigned a review assignment. The class period was primarily a work

period. The students worked diligently on the assigned material but the good-natured banter that was evident in previous classes was not displayed this day. As mentioned by the students earlier, my presence does have a sobering effect on the class. The students agreed to meet with me the next day but indicated that they were in the midst of their diploma exams and their in-class finals. They were feeling the pressure of the end of classes and were frustrated and a bit burnt out. I promised not to take too much of their time.

Interview Comments

On this occasion each of the student interviews were limited to 15 – 20 minutes so as not to keep them from their other activities. All of the students expressed a sense of frustration with the schedule of diploma exams (two parts for each) as well as a set of in-class final exams. The students were writing at least two exams per day for the last week of class. Their patience was wearing thin and the slow pace of instruction in the Math 31 course became a sore point again. Each student commented on the rate the students at the host site were working in comparison to their rate. The fact that this course ran at the end of the school day and extended 20 minutes beyond the end of classes at the remote site added to the level of frustration.

Each of the students was asked three questions. I wanted to know what had changed since the last visit, what they had learned beside math from the videoconference experience, and how they would summarize their experience. All three students indicated that not much had changed since the last class. They had accepted or adjusted to the way in which the class was being run and were satisfied with their performance to this point. The frustration with the pacing of the course and the perceived difference in the rate at which the students worked at each site had been expressed in each set of interviews but became a major issue at this point in the semester. The pressure of numerous exams made time management a primary concern. Anything that appeared to waste time was not viewed with a favourable eye.

When asked what had been learned in this class beside mathematics, a variety of responses emerged. Bob indicated that, "I've become a more independent learner… I've had to solve a lot of my problems on my own." He felt pleased with his ability to handle this course without the teacher being present and felt that this experience would help him in university next year. Cindy stated that, "I've had to rely more on [classmates] than in other classes. With no teacher we have to figure it out ourselves." Rather than viewing this as a positive experience, she continued to focus on the differences between the remote site and the host site with respect to access to the teacher. Mark

emphasized the friendship that had developed among the students at the remote site:

> I've learned a lot about [classmates]. We have become even better friends than before this class…without the help of the others in our group; none of us would be in the course now. We would all have dropped the course.

Mark added that:

> I've learned that technology is not the answer to all questions. It is not a substitute for a teacher…this was much better than taking the course by correspondence. None of us would have even considered doing that…it is close to being in a regular class but not as good as having a teacher here.

The topic of trust came up in the discussion with Mark. He stated that:

> …in order for this to work there has to be a trust between the students and the teacher. You have to trust the teacher before you can ask 'stupid' questions. You also have to trust the rest of the students too. Without that you aren't going to have the nerve to speak in class.

Mark indicated that trust was something that was built over time and that the visits Mrs. A made to the remote site were crucial in establishing that level of trust. When asked about the level of trust with the students at the host site, he stated:

> At first we were worried about what they might think or say if we asked stupid questions but we got to the point where we didn't care what they thought. We never knew them and probably will never meet them. [Cindy] still has a problem about asking questions but we can sort out the problems she has ourselves.

He went on to say that trust was a "two-way street", "…[T]he teacher has to trust the students' ability to do the work. She has to know that we are doing our best."

All students indicated that they were glad they had an opportunity to take a course that was generally not offered in their school. They felt that it opened more doors for them as they pursued post-secondary options. As for suggestions for students considering taking a course in this format they suggested that the students 'must really like the subject', 'must be able to work through things on their own', and 'get along well with the rest of the students in the class'. They indicated that this would be 'pure hell' for a single student to take a course in this format.

Summary

In this chapter I have described both the school setting and the physical setting of the videoconference suite where the instruction took place. The six students registered in the course were introduced along with the course teacher. A chronological report of the visits with the students was presented. Data for this research project were obtained from videoconference observations as well as four personal visits to the remote site. During these visits the class was observed and each of the students interviewed.

The initial interviews were focused on the changes in learning strategies and the students' perception of social presence and its role in the videoconference experience. Students were encouraged to express their concerns and identify issues related to their adaptation to this instructional setting. In subsequent interviews emphasis was placed on identifying changes, and the causes of these changes, that occurred in students' perceptions of the videoconference experience over the duration of the course. The students expressed a desire to have the teacher teach from the remote site as often as possible. The need for teacher support on an individual basis was expressed repeatedly. The students' primary concern was not with the technology but with the instructors' teaching style. They have become proficient in the use of the technology early in the course but negative comments related to the instructors teaching style persisted for the duration of the course.

The graph below represents the time each student stayed in the course relative to the site visits and observations.

Course Timeline

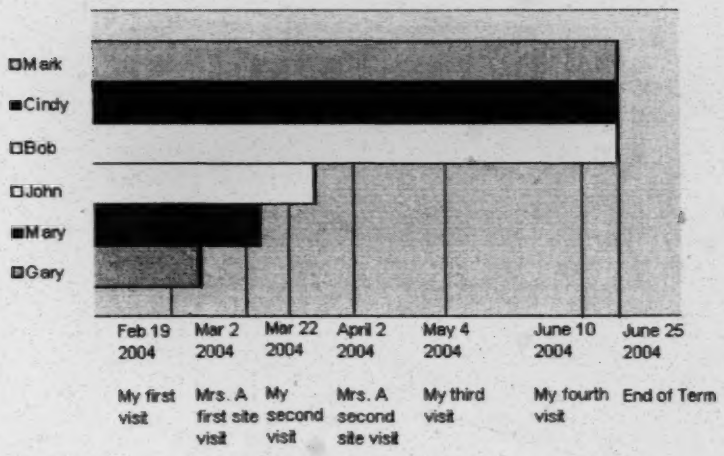

Figure 5: Student Completion Graph

Chapter Five

Identifying Changes and Patterns

Research in the area of videoconference delivery of courses has approached the topic from a variety of perspectives. The characteristics of the technology employed in the synchronous delivery of instruction and the development of pedagogical best practices have monopolized the literature in this area. Instead of examining the outcomes of the videoconference experience, this study has focused on the journey taken by this group of students, with the emphasis being placed on the changes that have occurred over the duration of the course. Studies have shown that students taking televised courses at remote sites perform as well as or better than those taught in a face-to-face setting (Cohen, Ebeling, and Kulik, 1981; Wetzel, Radtke, and Stern, 1994). If we examine the final grades of the students taking this course, it is tempting to say that there is no significant difference between the results of the students at the remote site and those at the host site but, Russel (1997) suggests, we are not appreciating all of the conditions and factors if we do not investigate further. Knipe and Lee (2002) have indicated that remote site students do not experience the same quality of teaching and learning as local site students in a videoconference setting. If this is the case, how do students who experience instruction that varies in quality produce results that are not significantly different?

In answering this question and in describing the experiences of these rural high school students taking a course by videoconference it is tempting to start by saying the students (plural) did … From the chronological account in Chapter Four it became apparent that each student had an experience that differed from that of their classmates. While the technological setting and the instruction provided was identical for all participants, the perception of the learning experience and their reaction to it was unique to each individual. The unique personal characteristics of the individual participants as well as the histories that each brought to the setting helped to shape their response to the learning experience. For this reason, I feel that there is value in examining the individual experiences of each participant. In this small group of students we see characteristics and mind sets that are evident in other high school students in other instructional settings. By examining the concerns of, the issues identified by, and the perceptions of these students we can begin to take proactive steps to improve our practice. While each student provided unique insights into the videoconference experience, there were a number of patterns and themes that have emerged from the data. The analysis of the data includes an account of each student's reaction to the experience as well as the identification of these common threads that emerge from these experiences.

Student Accounts

This study has focused on the students' reactions and adaptations to a change in their instructional setting. Fullan (1982) indicates that little has been done with respect to obtaining a student perspective on change but implies that change may be met with a variety of responses. It may be met with indifference or confusion, looked upon as a temporary escape from boredom, or result in heightened interest and satisfaction with school. As I reflect on the experiences related by this group of students I see all of these reactions or outcomes or combinations of these responses emerge from their stories. Each of these students may be placed on a continuum that represents their willingness to change. At one extreme we have students that are resistant to personal change and demand that the instructional setting adapt to meet their needs while at the other extreme, we have students that embrace personal change and strive to find ways to gain as much from the experience as possible. With this as a contextual backdrop I have examined the experiences of each student and traced their paths through their time in the videoconference course.

Mary

Mary entered this course with a sense of excitement and anticipation that was shared by all of the participants. Her interest in

education as a possible career and the opportunity to try a new mode of instruction were the primary reasons for enrolling in this course. Mary had a positive attitude and while she described herself as "not being a strong math student" she felt that any challenge could be met with hard work. Of all of the students in this project, Mary struck me as being the most self-reflective. Her comments focused on questioning what she was doing successfully or unsuccessfully and not questioning external factors such as the nature of the instruction. Positive comments were made when questioned about the way in which the course was being delivered, the teaching style of the instructor, the relationship with the peers in the class, but all of her comments were accompanied with statements of self-doubt.

The absence of the teacher was the primary topic of our first interview. Mary indicated that it took longer to "get to know the teacher" in the videoconference setting and that getting to know the teacher was crucial to success. She indicated that she needed the teacher for assistance, support, and motivation and was "nervous about going it alone". While, technically, there was real time access to the instructor and connections with the other students at the remote site, Mary viewed this setting as one which isolated her from the supports she required for success. She commented on the need to be self-motivated in this setting and indicated that she had to "really force

myself to do the work". Her former math teacher, who she had taken courses from since Grade 9, had forced her to do her work and she found the change from external motivation to self-motivation a challenge.

Of the six students at the remote site, Mary was the only one that identified the teacher as the first and primary source of help. Her comments indicated that it was a big change from getting teacher assistance to relying on her peers for help. The phrase "scary but good" was used to describe the change but, at the same time, she recognized that this was something she had to consciously work at. Mary noted that, while the technology provided the means for verbal and visual interaction with the instructor, she felt removed from the support normally derived from the presence of the instructor and did not call upon the instructor for assistance. Similar to findings by Kelsey (2000), factors such as comfort level with the teacher, relationships with other students, and the instructional style may contribute to an individual's willingness to ask for assistance. The fear of appearing 'stupid' in front of strangers may inhibit interaction even if it were technically possible. Mary indicated that her peers in the classroom had similar backgrounds when it came to math instruction and "they could explain the material in the way that they had been taught" but she still missed the teacher's presence.

The words 'private' and 'personal' occurred quite often in my first interview with Mary. In her mind these were characteristics of a positive learning environment. In describing the learning experience she compared what she saw as the learning environment of the students at the host site to their experience at the remote site:

> It is much more private for them. If they have a question they just have to call Mrs. A over and she can help them. We are on public display and if we want to ask a question, we have to interrupt their class.

The fact that the document camera was used in the initial stages as the primary mode of instruction probably contributed to this sense of separation. The students at the remote site were on camera all the time while the output from the document camera was the primary display from the host site. The students at the remote site did not get to see the students at the host site other than for the first few minutes of class. The relative infrequency of the instructor checking for understanding may also have contributed to this feeling of separation and isolation.

While the absence of the teacher created concern for Mary as far as providing support and motivation, she did perceive the absence of the teacher as a factor that helped to create a more relaxed atmosphere in the classroom, "Things are much more casual here that in a regular class." She went on to indicate that the class could mute the audio and compare answers and discuss the problems without interfering with the

host site. The absence of the teacher created an atmosphere in which the students were more willing to engage in collaborative attempts to solve problems.

Mary also commented on the need to focus on one location more than one would in a traditional face-to-face classroom, "In a regular class things are going on all around you. The teacher is moving around and can come over and help you. Here everything is coming out of the monitor." She added that she had to "listen and watch more closely" so as not to miss what was being said. This confirms Nichol and Watson's (2000) description of viewing videoconference instruction as 'the prisoner of the window' effect. The field of vision is restricted to that which comes from the monitor and prolonged viewing creates noticeable stress. Mary indicated that there were fewer distractions than were present in a regular classroom but it was tiring focusing on one spot for the duration of the class.

Mary was one of three students at the remote site who were also registered in a physical education course that conflicted with the last 20 minutes of the math course. When she registered in the class she had hoped that the math instruction would be finished within the first 40 minutes of class. She had hoped that the time she would miss would be time the class would be working on assigned questions. This had been

the daily routine within all of her previous math courses. She was disturbed with the fact that the instruction was still going on when she had to leave. This, accompanied with the lack of direction from the teacher as to what was to be completed for the following day, created some confusion.

About a week before my second visit to the remote site, I received an email message from Mary indicating she had dropped the course. When asked if she would be willing to talk with me when I visited the school again she indicated that she would. Mary still maintained a positive attitude and indicated that the month and a half she had spent in the class was a "good experience". She had nothing but praise for the fellow students who had helped her during the course and for the teacher that had to adapt to a new mode of instruction. Her primary reason for dropping the course was the lack of the physical presence of a teacher for support and motivation. She felt that there was still a lack of assistance being provided by the teacher but was unwilling to ask for help in this setting. Mary stated that, "I'm not very good at teaching myself stuff." There was still the feeling of isolation that was mentioned in the first round of interviews. She felt that she was being a burden on the other students in the class who were also struggling to understand the material. Mary also indicated that the quality of the assistance received from her peers was not the same as

that she would receive from a teacher. While Holmberg (1983) indicates that to master the content, learners must engage in an internal didactic conversation, the degree to which this internal conversation occurs appears, as indicated by Schmidt and Faulkner (1989), to be dependant on the support structures built around the learner as well as the need for direct interaction with a classroom instructor.

In examining four models of attrition in distance education, Osborn (2001) indicates that three constructs; entry characteristics, social integration, and academic integration are central to understanding student decisions and actions in completing a course. While Mary had the social support of the peers in her class, she entered with a weak background in the subject matter and, more significantly, a strong need for external support and motivation which she was unable to obtain in this setting. The question that arises is; How do we identify these entry characteristics in a videoconference environment early enough to meet the needs of these individuals?

Gary

Gary entered this course with a positive attitude and was extremely pleased with the opportunity to take the Math 31 course delivered in a form other than correspondence. Gary indicated that this course was a required course for the program of studies he planned to

pursue after high school. Of the six students taking this course, Gary was the only student who had taken a course by videoconference prior to this class. He had completed a five-week Career and Technology Studies module on tourism in the previous semester. The novelty of taking a course in this format was not as prevalent as in the other students and his initial comments focused on the opportunity this course provided rather than the nature of the technology.

From videoconference observation and on-site observations, Gary appeared to be a very quiet student and did not interact very much with the rest of the students in the class. In our first interview, Gary indicated that the group of students taking this class was not the regular group of friends that he normally associated with. When asked where he normally went for help in a classroom setting he indicated that he regularly checked with friends for assistance in class. He indicated that he did not feel comfortable asking the students in this class for help. He referred to his classmates as acquaintances rather than friends. At this initial stage he did not perceive the absence of this support structure to be a problem.

Gary indicated that the initial uncertainty on the part of the entire class regarding the operation of the technology had created a bit of tension and frustration but as the students became more competent in its

use, a more comfortable classroom atmosphere had developed. He observed that gaining competence in using the technology added to the adjustment to a different teaching style and the introduction of new course content had created a considerable amount of frustration, which each student was handling with varying degrees of success. In his case the different teaching style and the manner in which the material was being presented provided the biggest challenge.

Gary identified the videoconference delivery of the Math 31 as demanding a "more independent style of learning". When questioned about what he was 'independent of' he stated that he had to work independent of the teacher and his normal group of friends that provided support in the past. The lack of the physical presence of the teacher was, again, identified as a drawback of this mode of instruction. While there was the opportunity to talk with the teacher, this student did not feel comfortable doing so. Gary identified the importance of getting to know the teacher as factor contributing to his willingness to engage in dialogue with the instructor. He said, "It is harder to talk to a machine than it is to talk to a person." At this point in the course he felt like he was talking to a machine. Gary also indicated that there was no one he could go to after class for assistance. This had been a significant factor in his success in a number of his regular classes.

In addition to identifying the difference in the teaching style of the videoconference instructor, Gary was also very aware of his personal learning style. He knew what worked for him and what did not. He stated that he had to "listen more" than he would have to in a regular class and that he needed to "see and hear the work" in order for it to make sense to him. Gary described how his previous math teacher used to write out the problems, identifying the significant information and highlighting the directing words prior to solving the problem. The open outlines that Gary received from Mrs. A were viewed as "lumps of stuff" that he was challenged to read and interpret. While the instruction provided step-by-step solutions to the problems, Gary had difficulties identifying what prompted the solution. He stated that the current delivery form was not matching his learning style but that he was working at adapting to "a more independent style" of learning. These adaptations involved "listening more" to what Mrs. A was saying before she solved the problems and reading (and re-reading) the questions on the handouts as they were being covered.

While Gary did not mention the fact that he was enrolled in the Senior Physical Education course that took him out of class 20 minutes early, he did relay a sense of frustration with the lack of direction the course was taking. The uncertainty of what was due for the next day

and the reluctance to ask his classmates for the information provided in the latter part of the class added to his dissatisfaction with the course.

Observations made over the next month indicated little change in Gary's participation in the developing dialogue in this course. The visit of the teacher to the remote site had helped establish a level of conversation that had not been present to that point. Just prior to my second visit Gary indicated that he was dropping the course. He agreed to talk with me on my second visit.

In our conversation, Gary indicated that the Math 31 course was not like the Career and Technology Studies (CTS) course he had taken by videoconference in the previous semester. The CTS course had happened once a week for a five-week term whereas this course occurred every day for a full five-month semester. He indicated the CTS course was "not too hard" but trying to keep up with the math course was "tough". The difference in the time interval between classes and the level of difficulty of the math course made it hard to "keep up". Gary also indicated that his parents had recently separated and that he was having a difficult time focusing on his studies in general. This course, not being a required course for graduation, was a logical candidate to be dropped so that he could spend more time on the remaining required courses.

Gary repeated his concern about the way in which the information was being provided in this course. He preferred a "gradual presentation" of material and not have it given "in one lump". Reading and interpreting expectations and directions from the material provided remained a challenge accompanied with the lack of someone in the classroom to guide him through the material. Gary still felt isolated from the teacher although he said he felt a closer connection to her after her first visit but indicated that he did not feel comfortable asking her for help. He suggested that an earlier visit by the teacher to build the student-teacher relationship might have helped, "She could have seen how we learn and change her teaching to match the way we learn."

Gary questioned his own involvement in the course, stating that taking the course in this format is "just like watching TV". He acknowledged that he had been primarily a passive observer and not an active participant in the course, citing the lack of any close friends in the class as a reason for his lack of participation. He perceived the rest of the class to be "catching on" and did not want to "continually bug them" for help. Gary also conceded that the absence of the teacher allowed him to take a more passive stance in the course, "She was not here to see that we got our work done … It was easy to let things slide." While the majority of the literature related to video conference course

delivery is based on research with adults, Baynton (1992) suggests the difference in levels of self motivation and initiative between adults and secondary school students may question the transferability of some findings to a younger group.

A number of factors had contributed to Gary dropping this course. External family issues had contributed to an unsettled semester along with the inability of this mode of delivery (or the instructional style used in this particular course) to match his preferred way of learning. The lack of social integration into the group of students in the class and the lack of familiarity with the teacher led to a reluctance to ask for assistance. The similarities between the videoconference environment and watching television may have contributed to this student's passive stance in this course. This, unfortunately, may have been further promoted by the use of the lecture method as the primary mode of instruction. Increased interaction and checks for understanding on the part of the instructor may have assisted in engaging the students.

John

John entered the Math 31 course curious about the use of technology in delivering courses. His primary focus was on how the technology worked and not on the content of the course. During the

first round of interviews, John indicated that he needed more personal interaction and direction than this environment was providing. He, like Gary, indicated that he did not know the rest of the students in the class very well and did not feel comfortable asking them for assistance. When asked where he went for help in a regular class he said he didn't go to anyone. He did what he could and left the rest in hopes that the teacher would go over the material the next day. Having said that, he regularly asked me for help during my visits to the remote site and his comments in describing the videoconference environment focused on the lack of access to and support from the teacher. John echoed the responses of the other students in indicating that this mode of delivery required a more independent style of learning. The separation from the teacher was highlighted as the primary shortcoming of this course. John was the third student of the group enrolled in the Senior Physical Education course that took him out of class 20 minutes early every day. He had thought that the lesson portion of the class would be over by that time and that the class would be working on assigned problems. John was rather frustrated to find that the lecture was still going on at the time he had to leave.

The connection with the teacher was a main topic of conversation in our second round of interviews. Mrs. A had made a visit to the remote site and John indicated that he appreciated having her there. He

stated that it was important to get to know the teacher and that the dialogue between the classes had improved since her visit. He said, "It's important for [Mrs. A] to get to know our differences and that is hard to do over the TV." He was satisfied that the teacher's visit had started to help identify those differences.

John recognized that he was getting behind in this course due to sporadic attendance and indicated that he needed to do more work at home to catch up. In his mind, the lack of the physical presence of the teacher allowed him to fall behind. He identified the need for self-motivation in this setting and admitted to not forcing himself to keep up. He also commented that the math course was working well for those who were keeping up with the pace of instruction. His concern now centred on the means to catch up. In a regular class it was possible to meet with the teacher outside of class time and work through the missed material. John did not see this as an option in this setting even though the teacher had offered to run tutorial sessions by videoconference after school.

Dissatisfaction with the type of instruction was expressed. John felt that there was no connection being made with prior knowledge and no direction as to where the course was going. He indicated a need to know why the mathematical processes worked not just how they

worked, "We need more teaching – more explaining why we're doing this." This comment paralleled those of other students in the class but the degree to which it bothered each student varied. Some were content with a procedural perspective on the subject matter while others were concerned with making connections with prior learning and future applications. John linked his falling behind with the nature of the instruction received.

John stated that he did not see any difference in the way he functioned in this class as compared to a regular class. No changes had been made to accommodate the change in the delivery mode. By this round of interviews he conceded that there might be a need for a change in the way he approached the course. He needed to catch up in all of his courses but realized that this was easier to do in a regular class with access to the teacher outside of class time than in the videoconference class. John did not view the problems he was having in this course as major problems but a number of 'minor questions' and that he needed 'just a little help'. Kelsey (2000) indicates that students may be reluctant to ask for assistance for a number of reasons, one being the perception that the question is not worthy of interrupting the entire class over. John felt that small problems were normally answered in one-on-one personal conversations rather than being brought before the entire class.

Prior to my third visit, John informed me that he had dropped the course. He indicated that he had fallen behind in all of his classes and found that it was easier to catch up in those classes in which he had direct contact with the instructor. The remaining courses in his schedule were core courses required for graduation while this was an optional course. The lack of a local support group along with the absence of an acceptable mechanism to make up lost ground had taken its toll. While the videoconference technology provided a mechanism to span the geographical distance between the learner and the teacher, there still exists a psychological and sociological gap that must be bridged. The personal willingness to engage and the peer supports for engagement in this environment seem to vary from individual to individual.

Bob

Bob struck me as being a very self-motivated and self-controlled individual. He had a very clear idea of how things should happen and became frustrated when things did not work as expected. He controlled his frustration well and did not express it during class or take it out on others but it did affect his ability to concentrate at times. During the initial interview the word 'frustration' was used frequently to describe the first few weeks of this course. The technological glitches that had

occurred during the first weeks along with the lack of background in how to manipulate the technology had made it difficult to focus on the new course content. The change in teaching style added to his frustration but Bob was very gracious towards the teacher, recognizing that this was a new experience for her as well, and, at the same time, hoping for change as both parties adapted to the new environment.

Bob, along with the other students, commented on the differences between the students at the host site and their class at the remote site. The perceived differences in abilities and the real differences in the rates at which work was being completed led to inefficient use of time, which added to his frustration. The absence of the teacher further compounded this distinction. If the teacher had been present she would have realized the differences and adjusted her instruction accordingly. None of the students was willing to bring this issue to the attention of the teacher.

Bob quickly adapted to the difference in teaching styles. Initially, he indicated concern about the lack of time during class to work on assigned material. Ten days into the class he commented that he was adapting and "learned what to listen to and what to ignore". While he was not afraid to ask questions he did find it difficult to find time to ask. With the majority of the class period devoted to lecture and with

the time delay in audio transmission between sites, Bob found it difficult to time his enquiries without appearing to interrupt the instructor. The technology provided the means of communication but the time delay, along with pedagogical issues, introduced what Kelsey (2000) called a hindrance to spontaneity and lucid flow in conversation and, in turn, a reluctance to initiate dialogue with the teacher.

In describing the learning experience at this initial interview, Bob used the term 'independent' to indicate the most identifiable characteristic. He was very articulate in identifying both the positive and negative aspects of this characteristic. From one perspective the absence of the teacher was a detriment to his success in that he did not have ready access to teacher assistance as he would in a regular classroom. For reasons cited above, the dialogue that occurs normally in a face-to-face classroom did not flow as easily in this environment. Bob made the comment, "The teacher's here but she isn't," to express his concern about the extent to which he was receiving teacher support at this stage. From a positive perspective, he indicated the move toward more self-reliance as a goal worth striving for and an ability that would be valuable in future studies. While the change process was fraught with apprehension, the goal seemed to be worth the anxiety and frustration encountered in achieving it. Bob, also, noted that the absence of the teacher in the classroom allowed for the creation of a

more relaxed atmosphere in the room. In the early stages of the course, the majority of the students were adjusting to the absence of the teacher support they had been accustomed to in their other classes and, as part of that adjustment, were relying on one another for support. Bob noted that the absence of the teacher made it easier to talk with his peers in the classroom than would be possible otherwise. Bob tended to work independently but was very willing to compare results on assigned problems and was more that willing to offer assistance when asked.

Bob's sense of independence was expressed as being independent of the teacher. When asked about the relationship with the students at the host site, Bob indicated that there was an initial curiosity and desire to become familiar with those students. Ten days into the course this desire had dwindled – partly due to the way in which the course was delivered, the nature of the course content, and partly due to the use of the document camera as the primary delivery device. The lecture method was used to provide the instruction with the occasional check for understanding. There was no opportunity for dialogue between the students at the two sites. The students at the remote site rarely saw the host site students due to the camera being focused on the instructor or displaying the output from the document camera.

The distance between the students at the remote and host sites was also enhanced by what Bob labelled as differences in school cultures. The nature of the questioning by the host site students, as well as their relationship with the teacher, differed from that present in the remote site school. The host site student's relative ease of access to the instructor and their comfort level in relating to her created a perceived gap between the two groups of students. Bob commented that in order to succeed in this course he needed access to the teacher and that the relationship with the students at the host site was not essential for success in this course. This parallels findings by Kelsey (2000) and Ritchie (1993) which indicate that interaction with students at other sites is not viewed as a significant factor in success or in perseverance in a course.

Unlike some of his classmates, Bob did not view the lack of familiarity with the host site students as a barrier in interacting with the instructor. He commented that it was awkward trying to "get a word in edgewise" during the lecture but that Mrs. A was very good at responding to all questions asked. He did not hesitate to ask for assistance if the class, as a whole, could not agree on a solution. He indicated that the questions posed by the students at the remote site were "just as valid" as those asked by the host site students. Bob also

added that questions posed by the students at the remote site often prompted further questions from the host site students.

By the second remote site visit, Bob indicated that the greatest change that had occurred was that the students had become familiar with the technology. They did not have to focus on its use but could concentrate on the instruction. The videoconference technology had moved from, what Heidegger (2001) described as, being present-at-hand to being ready-to-hand. The shift had occurred from the focus on the presence of the technology and the questioning of its operation to a concentration on the instruction with the significance of the technology receding. Along with the increased familiarity with the technology came a reduction in the level of frustration in this student.

The instructor had paid a visit to the remote site between the first and second round of interviews. Bob emphasized the importance of such visits. He believed that getting to know the abilities and the problems that individual students had was crucial to providing individual support. Bob indicated that Mrs. A became familiar with the individuals in the class and developed a bit of an understanding of their abilities and areas in which they were experiencing difficulties, "She now knows who to pressure and who to let up on." Bob stated that this better understanding of the students in the class had led to a more

cordial atmosphere in the classroom and added to the comfort level among the students.

During the first round of interviews, Bob did not indicate that getting to know the teacher was important to the success of this course. He had focused solely on the access to the teacher for assistance when problems were encountered in the course. At the second interview, Bob said that it was important for the students to get to know the instructor and for the instructor to get a better understanding of the unique characteristics of each student. He felt more relaxed in the course, more willing to engage in conversations with the instructor, and more open to comments made by the instructor. He also commented on the fact that Mrs. A had taken their suggestions seriously and had changed her instructional style to accommodate the remote site students' concerns. The adaptation on the part of the instructor was appreciated and, in Bob's words "made it easier to ask questions." Bob also indicated that the teacher now had more time for each of the four remaining students since the class had decreased in size. The more focused interaction included all remaining students and encouraged their participation. The visit by the teacher and the decrease in class size had facilitated more direct interaction.

During the second interview, Bob continued to view this mode of delivery as promoting or "forcing" a more independent style of learning. In the first interview this change in style had been commented on with some apprehension. There was a fear of the effect this would have on his academic performance but, at the same time, there was a perception that this was a change worth making. In the second interview, Bob voiced a more positive outlook on this change. He was experiencing success in the course and while he stated that he had to "work harder to figure out my mistakes" he also indicated he "learned more" by finding his own errors. The interesting observation from the second round of interviews was that, while Bob was actively involved in sharing with the remaining students, engaged in conversations, and assisting other students, he did not comment on the shared experiences but still referred to the learning that occurred as an independent event.

By the third interview, Bob commented on the changes that had occurred, not only in the climate of the classroom, but also in the teaching style of the instructor. He identified changes that Mrs. A had made to address the concerns of the students and expressed his pleasure in the way in which the course was now being delivered and the willingness of the teacher to listen and adapt to their needs.

The primary focus of our conversation was on Bob's perception of the development of a more supportive classroom environment over the duration of the course. There was no mention at this interview of developing a more independent style of learning but attention was drawn to the relationship that had developed among the three remaining students. While they were good friends before this course, Bob sensed a growing strength in their friendship and noted that the rest of their friends had labelled them as the 'Math 31 Crew'. To support their newfound identity, members of the group would use terms learned in their math course during conversations with other friends to annoy them. Bob stated that the remaining students could pick up on each other's moods and act accordingly. The absence of students that did not belong to their circle of friends was mentioned as a significant factor in the increased comfort level in the class and in the strengthening of the existing friendships.

Bob also expressed that there had been a dramatic improvement in his level of satisfaction in the course around mid-term. He attributed this increase to getting to know the teacher better (after a second visit), to the development of a supportive local group of students, and to the change in the nature of the course from theoretical development to practical applications. Of these characteristics, Bob indicated the help he had received from the other students was the primary development

since our previous interview. Similar to findings of Binar, Welsh, Barone, Summers, & Dean (1997) and Geen (1991), Bob stated the reduction in the class size had resulted in increased satisfaction. Bob commented on the students that had dropped the course and indicated that their absence "removed some of the annoying behaviours that were distracting". At this point Bob was "very satisfied" and stated that "it can't get any better."

The final interview took place near the end of the semester. All of the students were under a lot of pressure with in-class finals and diploma exams. Bob indicated that there had not been much change since the last interview but, when asked about what he had learned besides math from the videoconference experience, he stated that he was pleased with his growing ability to solve problems on his own and his strengthened friendship with the other students in the class. The course had been a positive experience for him and, while frustrating and challenging at times, he was proud to have made it through.

Cindy

Cindy seemed to have a very black or white view of the world. Things were either right or they were wrong with no shades of grey in between. Once something had been labelled it was very hard to change her opinion. Cindy was a very hard worker and set a high standard for

herself. She had experienced success and knew what it took to succeed. Like the majority of the other students, her initial focus was on the technology. The opportunity to take a course that would not have been available otherwise and the novelty of the videoconference setting had captured her attention and imagination. During our initial interview, the conversation that revolved around the technology indicated that Cindy saw herself as an observer rather than a participant. While the other students commented on the two-way, interactive nature of the videoconference technology, Cindy's comments such as, "This is just like watching a movie." and "...we can see her on the TV." Indicted her participation was restricted to watching and listening. For the five-month duration of this course I did not see Cindy initiate a conversation with the instructor nor did she ask any questions. She responded to the instructor when asked a question directly but relied upon her classmates for support when needed.

Cindy was very critical of the learning experience. She was willing to overlook the technical problems that had plagued the course during the first week because she saw the improvement as the class and the teacher became more adept in handling the technology but was not so forgiving when describing the teaching style of the instructor. The slow rate of delivery and the continual lecturing by the instructor made her want to "pick up the remote and find a different channel." The

repetition of the material, apparently for the benefit of the students at the host site, had created the perception that the students at that site were slower that those at the remote site. Cindy stated forcefully that, "We learn by doing and not by listening!" Other students in the class had quickly learned what to listen to and what to ignore but Cindy felt that the instructor's continual talking was hindering her ability to concentrate and get her work done. She was also annoyed by the lack of direction that was provided at the end of each class. Often the group of students at the remote site would complete more work than the host site students and be left with nothing to do while the host site students caught up to them. In Cindy's mind, time was not being managed very well.

Cindy relied heavily on Mary, the only other girl in the class, for assistance. If the two of them could not solve their problem they would then turn to either Bob or Mark. While she stated that she regularly relied on her fellow students for assistance in all of her classes, she did feel as though the class at the remote site were at a disadvantage because they did not have the teacher at their site. Cindy cited the difficulty in identifying where errors were occurring in the math problems. The novelty of the vocabulary associated with the course content and the multiple step problem-solving process made it hard to describe their thought processes. She felt that if the teacher had been

present to look over her shoulder to locate where the errors occurred she would have felt more comfortable in the course. The reliance solely on her peers for assistance was a change that Cindy did not feel comfortable with. If a problem could not be resolved among the group at the remote site, Cindy would encourage one of the boys to ask the instructor for help.

Some of the students had used the document camera to show their work to the instructor. Cindy was not willing to do this, stating that she did not feel comfortable showing her work to the entire group of students at the host site. She indicated that she did not want to appear 'stupid' in front of a group of strangers. Although she was not receiving assistance directly from the instructor, she was finding solutions to her problems through conversations with her peers. She felt as though she was keeping up with the class but she did not feel comfortable with the means by which she was doing it.

By the second round of interviews, Cindy indicated that nothing had changed. Mrs. A had made a visit to the remote site prior to my second interview. Cindy indicated that the class could ask questions directly when she was there but after she left, the class returned to what it was prior to her visit. Cindy did not see any benefit in the instructor's visit. While the other students commented on the benefits of getting to

know the instructor, it was obvious from Cindy's comments that the two of them did not make a connection. Cindy indicated that she had a hard time adjusting to the instructor's teaching style and, even though the instructor had been asked to pick up the pace and to provide more class time for independent work, this had not happened to the degree that Cindy had hoped for. Cindy was a successful academic student who could function with limited direct instruction and resented anything that stood in her way. Mrs. A had made a poor first impression on this student and Cindy was not easily swayed from this impression. The changes in the use of instructional time had been noted by other students in the class but had not been significant enough to change her opinion.

Cindy was still reluctant to use the document camera to present her work but was more than willing to use the interactive whiteboard to present solutions to problems. The novelty of the white board was sufficient to overcome her resistance to displaying her work but she still checked her work with that of the other students before writing the solution on the board.

Cindy's dissatisfaction had expanded from the use of class time to the way in which the class was being taught. She expressed a concern about the lack of background and connections with prior

mathematics that was being presented. This perception, which was also mentioned by two of the other students, was expressed as learning 'pattern recognition'. The rules used to solve the problems were not developed but merely presented as fact and the focus was on the process of solving problems using these rules. Cindy wanted to know why the rules worked not just how to apply them. Similar to findings by Richardson (2000), a surface type of learning was not sufficient for this student and the information required for a deeper understanding of the course content was not being provided.

At this point in the course Cindy had not developed a comfort level with the teacher consistent with asking for assistance. She was receiving sufficient support from the remaining members of the class to allow her to succeed. She indicated that she "just needed a little help." Similar to findings by Kelsey (2000), the nature of her questions was perceived to be insignificant and not worth interrupting the teacher over. Like John, she downplayed the importance of her concerns and viewed the type of questions she had as being ones that were normally answered in a one-on-one conversation with the teacher. Her confidence in her ability had grown over the duration of the course but there was still the expression of resentment at not having the teacher present to assist with the minor concerns.

Cindy had experienced a considerable amount of pressure to change over the first few months of this course. She had shifted to relying only on her peers for the support needed to find and correct errors. Initially she had worked closely with Mary but, in Mary's absence, she looked to Bob and Mark for assistance. Her marks had improved and she was achieving at a self-imposed level that was acceptable to her. She was not comfortable with the change. She had to work harder at achieving the level of performance she had become accustomed to and felt that she should not have to struggle to maintain that level of performance. She felt that if the teacher were present, learning would be easier. Cindy also felt that the other students at the remote site were adapting better or quicker than she was. "I know I should be able to change but it is hard!" In comparison to the others, she felt she was failing to adapt to the mediated environment. She had set a high standard for herself and, until she could perform effortlessly in that environment, she was anxious.

By the third interview, Cindy's focus had shifted slightly to the nature of the relationship between the remaining students at the remote site. The class was now down to three students and, while Cindy indicated that they were good friends before the course, they were better friends now. She indicated that they "had to rely on each other" and there was an indication that the perceived lack of support from the

teacher had been the adversity that had strengthened their support for each other. Paralleling findings by Binar et al. (1997), Cindy commented on the fact that, with the other three students dropping the course, the classroom atmosphere had become more comfortable, "We are more relaxed here now." When asked about what had contributed to the relaxed atmosphere, Cindy indicated that they now knew that they could succeed in this setting. The apprehension that was present a month earlier had dissipated.

While her personal confidence level had increased, Cindy still felt as though the students at the host site had the advantage with the teacher being present, "Here we are doing what the teacher should be doing. We have to do all the work ourselves." There was still a feeling of resentment in that they were picking up some of the teachers responsibilities. At this point, Cindy still did not feel comfortable asking the teacher for help. She relied on Bob and Mark who felt comfortable in asking the instructor for assistance. Fulford & Zhang (1993) found that students who did not interact directly with the instructor may benefit vicariously from the interactions of other students. This was evident in Cindy's case. By the end of the course, Cindy indicated that she had learned to rely more on her classmates than she had in previous courses, "We have to figure it out ourselves." The other students in the class made similar observations but they

interpreted them differently. While Bob and Mark looked upon this change as a positive learning experience which would benefit them in the future, Cindy still viewed it as a deficiency in this mode of instruction.

Mark

Mark impressed me as a person who had the ability to step back from a situation and examine it from a number of different perspectives. He had a keen interest in technology and the opportunity to take this course in this format appealed to him, not only from a content perspective, but also from a technology perspective. He had the ability to pick up on the reactions of others and to articulate their views, in some cases, better than they could. Mark was very well liked by the rest of the students and freely provided assistance when asked.

Mark took the initial technical glitches in stride and, while acknowledging that they were frustrating at the time, realized that as the group became more comfortable in the operation of the videoconference system these frustrations would subside. He felt free to ask questions but wondered about the perceptions of the students at the host site. Mark appreciated having the teacher present to answer questions and indicated that the questions asked by the students at his site were "as valid as those at the other site." Mark indicated that he

would not have taken this course if it were available only through correspondence. The presence of the teacher for responding to questions was a major factor in his taking this course.

Mark was a highly motivated, academic student and he appreciated the print material provided daily by the instructor. He listened until he picked up on the new material for the day and then worked ahead through the rest of the problems provided. He was continually ahead of the rest of the class and the instructor. On numerous occasions he was asking questions on material the instructor had not yet covered. During the initial interview, Mark indicated this was a more independent style of learning and his actions in the class bore this out.

While Mark had an initial curiosity about the students at the host site he quickly realized that it was the connection with the teacher that was significant in this course. He indicated, similar to findings by Kelsey (2000), Chen (1997), and Hilgenberg & Tolone (2000), that if the course required more discussion and did not rely solely on transfer of factual information there would be more of a need to connect with the students at the other site. He did not view the lack of familiarity with the students at the host site as being a barrier to asking questions but did look forward to getting to know the instructor better.

By the second round of interviews, Mark indicated that the relationship with the instructor was improving. The teacher had visited the remote site and Mark felt as though he had developed a better understanding of her personality and her sense of humour. The ability to speak with the teacher on non-course related topics was important for Mark and, while he had never been shy of asking for assistance, he now indicated an increased comfort level in doing so.

One of the major changes expressed by Mark was the move towards a more collaborative style of learning in this environment. Initially, he had labelled himself as an independent learner and did work by himself for a considerable portion of each period. As the friendships between the students strengthened they began to rely more on each other for assistance in the course and support for staying in the course. Mark noted that he was spending more time on a daily basis with the students in this class and he was increasingly engaged in conversations with the other students.

Concerns about the teaching style persisted. Mark was very diplomatic about referring to the teacher and the difficulties she must be having in adapting to this mode of delivery but he had become increasingly concerned about the procedural nature of the instruction.

In his view, they were being taught how to solve problems from a pattern perspective and there was little attempt made to develop a deeper understanding of why the rules worked. Mark indicated that he could "live with the way things are going now" but there was an underlying feeling as though he was being short changed. Mark's concern that a surface level, procedural style of instruction prohibited the development of a deeper level of understanding echoed the findings of Marton & Saljo (1976).

At the third interview a month later, Mark's attitude toward the course was considerably more upbeat. The progressive development of the local support group was the primary change that was noted. A sense of community had developed that included all three of the remaining students. Mark indicated that he appreciated the fact that the teacher was not physically present yet accessible. Her absence allowed for side chatter (with the mikes turned off) that contributed to the development of a more informal, relaxed atmosphere in the classroom. The students found a comfortable mix of getting their work done and avoiding boredom. Mark also noted that as the size of the class shrunk, the students' comfort level increased, as did their engagement with the course content. This confirmed similar findings by Binar et. al. (1997). When asked about the time taken to develop this sense of community (and questioned about steps that could be taken to speed up the process)

Mark indicated that there was nothing that could be done to get to where they were now, "It just takes time for friendships to grow."

Mark was the only student who commented on the changing perception of the physical space where the class was conducted. He commented that, "We have become one with the room." and went on to state that each of the remaining students had their own place in the room, their own job in getting the videoconference connection up and running, as well as ownership of the whiteboard to use as they needed. Other students had indicated the strengthening bond among the students and Mark viewed this as a development tied to a location. As Auge (1995) and Ashcroft (2001) stated, the development of a shared history over time created a sense of belonging and attachment with the physical location.

Mark indicated a steady rise in his level of satisfaction with the course. The increased proficiency in the use of the technology, the visits by the instructor, and the development of a strong support group all contributed to the increased level of satisfaction. Again Mark indicated that these events take time and there was nothing that could be done to speed up the process. Mark felt that without the support structure developed over the duration of the course, none of the students would have made it through.

In the final interview, Mark indicated that the videoconference experience was close to a regular class experience but not as good as having a teacher present. In comparison to correspondence, though, he indicated that this was by far a preferable mode of taking the course. According to Mark, the primary factor for success was the need for the development of trust between the teacher and the students. Students must trust the teacher before they are willing to ask "stupid" questions and the students must have a level of trust in their fellow students. Similar to findings by Handy (1995) and Zheng, Bos, Olson & Olson (2001), Mark felt that this level of trust had developed over time and its development was facilitated by the visits made by the teacher. Mark felt that the trust must work both ways. In addition to the students trusting the teacher, the teacher must trust the students in this mediated environment to do the best they can. He felt that the instructor must trust the students' ability to do the work assigned. Mark confirmed Rocco's (1998) findings indicating that the geographic distance between the teacher and students might delay the development of this trust.

Patterns or Themes

After numerous readings of the transcripts of the student interviews and in listening to the tapes of these conversations there

emerges a number of categories of concerns rather than patterns of behaviours. With a group of six students in this case study it is difficult to identify when a pattern exists. Do similar comments from two students form a pattern within such a small group? At the onset of this study, I proposed to identify the experiences of high school students taking a course delivered by videoconference. In so doing, the door was left open to capture the concerns and issues that were of primary interest to the participants. The concept of change formed the foundation of this study. How did the students change to meet the limitations of this mode of delivery? How did they adapt their learning strategies to function in this mediated environment? Looking back on these questions, the implication is that the mediated environment and the instruction are static and the change occurs solely in the learner. Conversations with these students have shown that the learning process was a dynamic one that affected not only the learner but also the instruction and the perceptions of the learning environment.

Four themes emerge from the collected data that may be used to describe the experiences of this group of students. As with any mediated experience, the technology employed introduced limitations as well as provided opportunities that did not exist prior to its use. The pedagogical style of the instructor as well as the expectations of the learners played a critical role in shaping the experience and the

perceptions of the participants. The basic individual beliefs as to what constitutes teaching, knowledge, and learning are questioned when challenged by differing assumptions. The third characteristic that coloured the learning experience was the personal characteristics of the learners and the social dynamics that evolved in the class. The unique histories brought to the setting, along with the negotiated positions taken during the course influenced the perception of the experience. Finally, the social and cultural context as well as the physical setting contributed to the development of the learning experience. At first glance these factors or influences may seem to be static in nature but, over the duration of the course, students' comments indicated that they changed or at least their perceptions of them changed.

The Technology

The students' initial comments were focused on the technology. The excitement of taking a course in a different format and the opportunity to become familiar with the new technology monopolized their initial comments. Ten days into the course, the technology was still the focus of their comments but frustration had replaced the initial excitement. As competency in the use of the technology increased there was a sense of empowerment associated with its mastery. The language used to describe the technology seemed to focus on it working or not working and not on how well it was working. When the use of

the document camera was replaced with the interactive whiteboard the students were quick to make qualitative comparisons between the two. With no prior experience in a videoconference setting, the students had nothing to compare their experience with. It is also interesting to note that the comments on the use of the technology were also linked to how the teacher made use of the technology. The quality of the medium was viewed in terms of its use.

By the second visit, the references to the nature of the technology had diminished to the point where I had to solicit comments. Mastery of its use, as Heidegger (2001) comments, had made its presence subside to the point where the focus was now on the instruction and not on the use of the tools. The technology itself had not changed but its perceived significance in the mediated setting had been reduced.

Reduced but not eliminated. While the phrase 'the next best thing to being there' has been used to describe the videoconference experience, it was still perceived by the students to be inferior to face-to-face instruction. Short, Williams, & Christie (1976) coined the use of the term 'presence' to evaluate communications systems on their ability to provide the illusion that a mediated experience is not mediated. The comments of the students in this study brought to light the fact that, while the medium can provide the potential for a rich

sensory experience, it does not guarantee that medium's potential will be met. Findings by Danchak, Walther, & Swan (2001) that indicate the actions of the participants as well as the medium contribute to the transparency of the technology were confirmed by the students in this study.

Prior to the teacher's first visit to the remote site, there was reluctance on the part of some students to ask questions and to use the various tools to display their work. The tools were present to facilitate this type of interaction but the findings by Hung, Dennis, & Robert (2004) were supported in that there was a perceived risk of appearing 'stupid' and a lack of trust that formed a barrier to such interactions. A number of students indicated that as they became familiar with the teacher they felt more confident in asking questions and using the interactive whiteboard to display their work but they recognized that this comfort level took longer to achieve than in a regular face-to-face class. The mere presence of interactive technologies does not guarantee interaction.

Each student at one point or another indicated that the visual and audio contact with the teacher was not a satisfactory substitute for the presence of the teacher. In the case of Mary, the absence of the teacher was cited as the primary reason for dropping the course. In addition to

the inability to get to know the teacher through informal conversation, each student noted that there was no technical way to allow for the teacher to look over the shoulders of individual students to provide guidance. Questions that were asked and all other interactions were conducted in the presence of the entire class. The technology did not provide an avenue for individual conversations. Even when the teacher offered to connect with students after class, there were no takers. As the course progressed and the students became familiar with the instructor, the comfort in interaction improved but students still commented on the fact that all interactions were public in nature and the minor concerns that would normally be handled in a short one-on-one conversation in a regular class went unanswered in this setting.

The Pedagogical Style

In contrast to the technology, the way in which the course was taught drew a lot of comments throughout the duration of the study. The students had taken their previous math courses from the same teacher for the past four years, had become familiar with her teaching style, and had been very successful to this point. The students initially perceived the change in teaching style as placing their accustomed success in jeopardy. The ability to adapt to this different instructional style is one characteristic that divided those that succeeded in the course from those that dropped the course.

Christensen, Garvin, & Sweet (1991) identified a continuum along which an educational experience can be described. At one extreme they identified teaching as telling, knowledge as facts, and learning as recall while this was balanced at the other end by teaching as enabling, knowledge as understanding, and learning as the active construction of subject matter. From observations and early comments from the students it was apparent that the teacher's view of course delivery was located near the first description while the students were hoping for an experience closer to the latter. Cindy's comments that the teacher "talked all the time" and "we learn by doing, not by listening to someone else do it" were repeated throughout the course. John and Gary also voiced concerns about the lack of connection with prior learning and with the procedural way in which the course was being taught. Those that were successful in the course were able to accept, though not necessarily embrace, the conditions of instruction and match the expectations of the instructor.

The instructor in this course used the lecture approach to deliver the course material. While the videoconference medium allowed for live interaction very little of that occurred in this course. There was the odd question asked and the occasional check for understanding by the instructor but there were also complete class periods where there was

no dialogue whatsoever. A number of studies (Dillon & Gunawardena, 1995; Fulford & Zhang, 1993; Lairos, 2000) have indicated that a more learner-centred approach has contributed to academic achievement and satisfaction but other studies (Bozik, 1996; Dillon, Hengst, & Zoller, 1991; Dupin-Bryant, 2004; Gehlauf, Shantz, & Frye, 1991) state that the vast majority of distance educators resort to teacher-centred teaching styles. The technology provides for an interactive environment but its presence does not guarantee that this interaction will occur. In discussions with this videoconference teacher and others, the presence of the videoconference equipment made the instructors very aware of 'dead air time' and the temptation was to fill that time. In their opinion, the reluctance on the part of some students to speak on camera further contributed to the teachers feeling the need to fill the space.

The initial lack of two-way discussions in this course led to concerns related to the help they were receiving from the teacher in comparison with the assistance that the host site students were enjoying. There were the occasional times when the students were asked if there were any questions but there was little directed questioning that required individual students to respond. The teacher-centred form of instruction made the students at the remote site feel isolated from the action. This was reinforced by the relaxed banter that

occurred between the instructor and the students at the host site. The students at the remote site could see the instructor providing individual assistance to the host site students but were unable to receive the same type of personal assistance. All of the remote site students commented that they did not have the teacher present to look over their shoulders and point out where errors occurred. This was a very noticeable deficiency in this particular setting.

In this environment, students at the remote site were forced to state their questions or concerns in front of the entire class while those at the host site had to ability to talk with the teacher one-on-one. This brought to light the distinction between major and minor concerns. Major problems were those worth interrupting the entire class to bring to the instructor's attention while minor problems were those that individual students perceived might be cleared up by checking with a classmate. An individual student's willingness to interrupt the class set the boundary between these types of concerns.

Student willingness or comfort in asking questions changed over the duration of the course. After the site visits by the teacher, some of the students indicated that they felt more at ease with the teacher and more willing to engage in dialogue. In contrast, though, Cindy did not ask the instructor for assistance throughout the course but did benefit

from, what Fulford & Zhang (1993) describe as, vicarious interaction through other students at the remote site. John also did not feel comfortable in asking questions in this setting. This may have been due to the same reason but also may have been compounded by the fact that he did not associate with the group of students at the remote site. During my visits he was more than willing to ask *me* for assistance on a one-on-one basis but was not willing to ask his fellow classmates.

I think that if the instructor had spent more time questioning the individual students at the remote site, the perception of isolation and unfair access to assistance could have been reduced. In fairness to the instructor, I must state that after our conversations following site visits and observations she addressed the students' concerns. The problem was that it took my visits and conversations with the students to bring these issues to light and then to relay them to the instructor. In a face-to-face setting this may have happened much quicker. With the introduction of the interactive whiteboard the teacher had the remote site students present their work. The students engaged in this activity but noted that it further slowed down an already slow delivery process. Providing checks for understanding slowed down the instructional process. In this case and in conversations with other videoconference teachers, the common issue brought up is the rate of delivery. The multiple cues used by teachers in a face-to-face setting are not present

in a videoconference setting but the information these cues relay must be gathered by other means.

The students also commented on the adaptation of the instruction to meet their particular learning styles. There was an expectation on the part of the students at the remote site that the teacher should adjust her teaching style to match the expectations of the students. The adaptation process is not a one-way process but one that involves changes on the part of all participants. It was interesting that the students at the remote site felt that they needed to wait until the instructor made a site visit to make her aware of their different learning styles. Cindy's comments about waiting for her to visit before telling her to speed up the instruction and provide more class time for work were added to comments from Gary that indicated that he was waiting for the teacher to arrive to see that they each learned in a different way. The expectation being that the teacher would adapt the instruction to meet their needs only after meeting with them. In their minds the adaptation process could only occur through face-to-face meetings. After the first site visit, John and Bob both commented that the course was running better as a result of the instructor getting to know the abilities of the individual students. This brings up a number of questions related to adaptation of instruction. What steps could have been taken by this instructor to adapt instruction to meet the learning styles of the remote

site learners earlier in the course? How can the students be encouraged to provide the information required by the teacher to adapt instruction to match individual learning styles?

The remote site visits were valuable in increasing the comfort level of the students. The students felt more at ease in conversing with the instructor and felt that the instructor had a chance to get to know their strengths and weaknesses through a short period of face-to-face time. The instructor also noted a better understanding of the students after a single visit and felt that the remote site visits were very valuable in understanding the needs of the students. Both Bob and Mark indicated that one of the key components of the course that increased their satisfaction level with the videoconference experience was the site visits by the instructor. Even Cindy, who remained critical of the way in which the course was delivered, appreciated the time taken by the teacher to visit their class. Bob, Mark, and John indicated that the way in which the course was being taught changed after the site visits by the instructor as well as after my conversations with the instructor following my observations and interviews. The need for feedback mechanisms that allow for the development of an understanding of the unique abilities of the participants in this mode of delivery is necessary. The remote site visits helped to match this need but the question that

remains is whether there is a way of achieving this level of understanding through the mediating tools.

Moore (1993) identified three elements of distance education: autonomy, dialogue, and structure. Examining the structure of this course, all students identified this delivery format as being preferable to taking the course by correspondence. The regularly scheduled class time and the presence of the teacher and other students taking the course at the same time provided the support needed for course completion. When presented with the 'any time, any place' advantage of correspondence delivery, Mark commented that, "Any time, any place turns into no time and no place." Without the structured setting and delivery format none of these students would have attempted this course.

All of the students commented favourably on the open outline that the teacher provided on a daily basis. These three or four pages provided an outline of the days activity, provided space for students to write notes, and complete problems. The collection of these outlines provided structure to the notes that were taken and highlighted the important concepts covered. Barker, Frisbie, & Patrick (1995) suggest that there are two aspects to course structure in a distance education setting: the traditional features such as the objectives, assignments,

tests, etc. and the presentation features such as the discussions, lectures, and other teaching activities. From discussions with the participants at the remote site, it was found that rigidity and consistency in the structured materials delivered was favoured while the inflexibility in the presentation features actually inhibited in-class discussion.

Personal Characteristics/Social Dynamics

The previous two sections discussed the students' reaction to the instruction and the technology used to deliver that instruction. From an instructivist position these facets of the course may be assumed to be the major contributors to the students' learning experience. Equally important are the tools, strategies, backgrounds, and histories that these students brought to the setting. If knowledge is to be constructed it must be built upon an existing foundation and with tools developed in the past. Russell (2002) states that:

> learning is not a neat transfer of information but a complex and often messy network of tool-mediated human relationships that must be explored in terms of the social and cultural practices that people bring to their uses of the tools they share (p. 73).

The students in this study were very aware of what had worked for them in the past, the preferred method of instruction, and what was required for success in their individual situations. Dependence on the presence of the teacher, visual vs. oral learning styles, knowledge of the personality of the teacher beyond the instructional setting, and the use

of classroom time were mentioned as issues unique to the individual participants. These students came to this class with a lifetime of background and experience in what worked for them and what did not work. Based on that experience, these students were readily able to make qualitative comparisons and to identify changes they would like to see in the instructional setting, as well as, changes that they identified they would have to make.

Qualitative comparisons to prior experience with the local math teacher were quick to surface. This group of students had taken their last four math courses from the same teacher and all had done well in those courses. The instructional strategies and teaching style of that individual was well established in the students' minds as the way math was taught. The students initially felt the success they had experienced in the past as being in jeopardy. The reactions to this threat varied from demands that the instruction change to the recognition that the change would have to happen in the individual learner. The willingness to change seemed to be an indicator of success in this particular course.

Richardson (2000), examining course completion in distance education courses, found that completion depends less on academic factors than on non-academic factors such as students' goals, approaches to learning, and personal support from the teacher. It can be

argued that these factors were present in the reasoning of the students that did not complete this course. Mary indicated from the start that she felt very uncomfortable taking a course without the teacher being present. Her first source of support had been the teacher in all of her previous classes and her confidence in being able to function without the teacher present was low. Mary had viewed the teacher not only as a provider of support but also a motivator. On a number of occasions she indicated that there was no way that the teacher knew whether she was getting her work done or not. Even with the help from her peers she was unable to continue with the course. Gary expressed concerns about the manner in which the information was presented. His approach to learning mandated that the information be presented in a progressive visual and oral form with the content being explained as it was being displayed. Large sections of material being presented at one time did not match his preferred learning style. Reading and comprehension in a math setting was something that Gary struggled with and when it became obvious that the teacher was not going to change her instructional delivery to match his need he decided to drop the course. John had enrolled in the course with more interest in the way in which the course was being taught than in the content of the course. The absence of the support from the teacher and the motivation that the presence of the teacher normally provided allowed his attendance to fall

off. When he realized this was affecting his grades he decided to drop the course indicating that it was not a high priority course for him.

It should be noted that the three students who did not complete the course were those who were enrolled in the senior physical education course. There was a twenty-minute overlap in the schedules of the math course and the physical education courses. The early departure of these students further segregated them from the remainder of the class.

The three remote site students who did complete the course indicated that the only reason they persevered was because of the support from the other students at that site. These students had been friends before entering this course and indicated that this friendship had grown over the duration of the course. The support that they drew from their fellow classmates was sufficient for them to succeed. This group of students indicated that the students that had dropped the course had not been close friends of theirs. The willingness to ask their peers for assistance seemed to have defined those that succeeded while those that did not feel comfortable asking their peers for help dropped the course. The development of a strong social support structure within the class did not extend to the students at the host site. The students at the host site were viewed in the same light as those at the remote site that had

dropped the course. While there was an initial curiosity about those at the other site, the nature of the course and the lack of opportunities to interact with those students quickly reduced any interest that may have originally existed. Hilgenberg & Tolone (2000) and Kelsey (2000) have indicated that interaction with the instructor is more important to students than interaction with students at other sites. This was borne out in this study as well. There was a strong desire on the part of all remote site students to get to know the instructor and for the instructor to get to know them. The chance to get to know the teacher's personality and sense of humour were viewed as critical in developing a relationship that would allow for ease of interaction.

After a single one-hour visit by the instructor, the students at the remote site felt as though they knew the instructor better and that the instructor had a better understanding of their individual abilities and weaknesses. The physical presence of the instructor for a short period of time had done more to create an understanding of each other, reduce the feeling of isolation, and increase the comfort level associated with interaction than over a months worth of videoconference interaction. The opportunity to have some one-on-one time with the teacher, however brief it may be, was significant in boosting the morale of the students and in encouraging them to persist in the course.

The terms 'independent' and 'collaborative' were used to describe the learning styles that developed as the students progressed through this course. Moore (1993) defines learner independence or autonomy as one of three constituent elements of distance education. Students in this course readily acknowledged that they were working independently but when asked about what they were independent of, the responses ranged from being independent of the teacher to being independent of help in the course. The response to this independence varied from fear on the part of Mary to an invigorating challenge on the part of Bob. All students recognized that the independent nature of this videoconference course either required or forced them to change the way in which they functioned in the class. The degree to which they embraced this change was closely related to their satisfaction with this course. Baynton (1992) and Chen & Willits (1999) found that independence or self-directedness is a key concept in the area of adult education and particularly in the area of distance education. It is important to note that the development of the ability to function independently was a challenge for a number of these high school students. As a result, we must be wary of applying the findings of research in mediated instruction with adult learners to younger students, as it seems that younger learners have different needs.

A very close, supportive relationship developed between the three students who completed the course at the remote site. They worked together on a daily basis in class and also got together to work on assignments outside of class time. These students indicated that they had developed an understanding of the others in the group to the point where they knew where each one was most likely to make a mistake. Also, they could tell when one was having a bad day and could respond accordingly. It was this active daily engagement with each other that the students labelled as collaborative learning. It is interesting to note, similar to Garland's (1994) findings, that this collaboration or provision of support went beyond matters directly related to this course to include sharing of experiences outside of school. Mark indicated that the learning experience had both an independent and a collaborative component to it. When questioned about the apparent contradiction in terms, he disagreed and stated that while they were independent of the teacher their activity in the course was very much a group effort on the part of the three students at the remote site. Bob indicated that the development of the strong support group at the remote site had developed out of the feelings of isolation or independence from the instructor. Cindy's comment that, "we are doing what the teacher should be doing" also speaks to the development of a collaborative approach in response to the absence of the instructor.

Over the duration of the course, the connotation of the term 'independence' seemed to change in the discussions with the students. Initially, a sense of frustration and isolation was conveyed by the use of this term while near the end of the semester there was a sense of freedom associated with the use of this term. By the end of the semester the students proved to themselves that they could function in this environment and enjoyed the relaxed atmosphere that the absence of the teacher provided. While working on assignments, the students could mute the audio and chat socially as well as work on course material. Mark indicated that the side chatter allowed them to find a comfortable mix between getting the work done and being bored. As Curtis & Lawson (2001) suggest, such off-task activities may have an important social function in enabling learning interactions.

The Social and Cultural Context

The context of a study is often viewed as a backdrop against which all of the action takes place or a container that sets boundaries to the transferability of the findings of a given study. The students in this study quickly recognized what they perceived as a difference between the expectations of the host class and themselves. The remote site students brought with them a history of educational experiences gleaned from a school that prides itself in its academic achievement located in a community with a business and professional orientation. In contrast,

the host site was located in a community with a cyclic, resource based economy.

The students at the remote site indicated that their previous math courses had been taught by a well established member of the teaching staff of their school who was described as being well organized, very demanding, and having high expectations of all her students. In comparison, the remote site students perceived the instruction delivered by the videoconference teacher to be slower paced, procedural, and containing more repetition than they needed. The majority of the initial comments from the remote site students focused on the perceived differences in the two student groups and in the manner in which the course was being taught. Mark wondered whether the host site students had completed the prerequisite course based on the types of questions being asked while Cindy expressed frustration in the rate at which the teacher taught the course and the rate at which the host site students completed their work. On a number of occasions the remote site students would be left with nothing to do because they had completed the assigned work and were waiting for the host site to catch up. Cindy commented that if this were going to work we would have to find groups of students that had similar backgrounds, similar abilities, and were "more alike". It became very clear through the discussions with the students that the community and school culture had shaped the

histories they brought to the learning experience and, in turn, had driven the expectations in this setting. Rather than being a mere backdrop, the setting of this study was an integral part of shaping the learning experience.

On a more localized basis, the classroom context at the remote site was one that changed over the duration of the course. Initial demands, in the form of mastering the use of the technology as well as adapting to a different teaching style, created a rather stressful learning environment for the students. By the second round of interviews the students had mastered the use of the technology and expressed a sense of relief, satisfaction, and a feeling of empowerment in their ability to function in this mediated setting. Bob's comments, about knowing how to use the technology and knowing what pieces to use for what purposes, were echoed by other students.

While the initial focus was on the technology and the pedagogy, the students' comments soon turned to the social relationships and the increasingly comfortable environment that formed the setting for the class. As students started to drop the course, the three students that completed the course commented on the classroom environment becoming more relaxed and easier to function in. The three remaining students had been close friends before the class and that circle of

friends did not include the students that had dropped the course. The comfortable feeling associated with the class seemed to grow out of the strengthening relationship between the remaining students. This comfortable feeling was expressed in terms of mutual support, a sense of ownership of the classroom, and control over the environment.

I entered this study with Moore's (1989) transactional distance theory in mind. The distances between learner and teacher, learner and learner, and learner and content were expected to appear in the student comments. To a large extent they did manifest themselves in this study but, while the connection between the students at the two sites did not develop, the level of understanding and interdependence between the students at the remote site did develop and formed the basis for the drive to continue in this course. Students who were not taking the course by videoconference recognized the development of a strong support group among those who were taking the course. Other students in the school labelled these three students as the 'Math 31 Crew'. This labelling was looked on favourably by the students in the course and was reinforced by the actions of these three students. It might be argued that this small group formed a 'mini-culture' within the school and through their own actions worked towards establishing and reinforcing their identity.

Over the duration of this course a sense of connection with a group of people and a particular space developed. The students developed a shared history that did not exist in their school setting prior to this course. As mentioned earlier, the context of a study is often thought of as a static backdrop against which the action occurs but I think we can argue that it is a constantly changing element that develops over time and contributes to the learning experience of the participants. This shared history that developed over the duration of this course was linked not only with the relationship between the people involved but was also linked with the physical location of the course. The development of control of the technology and the ability to master its use provided a sense of empowerment associated with the videoconference room. Connected to this was the development of a sense of community that provided the required support and which produced the results the students had expected. Each of the students indicated that their success in this course was closely connected to the support received from their classmates.

The videoconference room had changed from a space where instruction occurred to a place where learning happened. Mark's comment, made near the end of the course, that the students "have become one with the room", relays a sense of belonging as well as a sense of ownership and connection to a location. He followed this

comment with the statement that the room was "a place where good things happen." The physical setting of the course had changed in the minds of the students over the duration of the course. Mark went on to state that if he were to take another course by videoconference he would come into the course with the knowledge that this mode of delivery works and with the confidence required for success. While the other two students did not relay the connection with the room as eloquently as Mark did, they frequently used terms such as "our room" or "our place" in reference to the videoconference room. It was clear that the students had developed a sense of belonging in the videoconference classroom. They were comfortable in the room, utilized the resources of the room, and relayed a sense of ownership and control over the location.

In the last set of interviews, I asked the students what they had learned from the videoconference experience beside the content of the course. Each student commented on the relationship that had developed among the students at the remote site and each indicated that, without the support received from their classmates, they all would have dropped the course. When asked what could be done to support and speed up the development of this relationship, the students indicated that the development of trust and understanding takes time and that there was nothing they could suggest as a process that could speed up the

development of this support community. They suggested that the *physical presence* of classmates was important to the development of community. These students indicated that the context of this course had changed over the five-month term and that they walked away from the experience, not only with an understanding of the course content, but also with a better understanding of what it takes to function in a mediated instructional setting.

Conclusions and Recommendations for Further Study

I entered this study with the desire to listen to the experiences of high school students taking a course by videoconference. Providing the students of this age group a chance to voice their concerns and to identify issues related to mediated course delivery seemed to fill a void in the existing literature in this area. I drew from literature in the areas of distance education, mediated instruction, social presence, and videoconference delivery from an adult education perspective. This literature painted a promising picture of videoconference instruction providing a solution to educational needs developing in rural areas. At the same time I was troubled by comments from researchers such as Heim (1993) who suggested that videoconferencing provides "only a simulation of face-to-face meeting" (p. 102) and does not provide the "fleshly bond between people that supports long-term warmth … required to produce a sense of loyalty" (p. 102). Being a relatively new

application of videoconference technology, I was interested not only in the reactions of high school students to this mode of delivery but also concerned about the changes and adaptations these students would need to make in order to succeed in this setting.

This case study focused on a particular situation involving a very small group of students. As such, the ability to generalize to a greater population may be limited (Yin, 1994) yet the reader is invited to determine the extent to which this study may apply to their situation. I set out to describe the experiences of a small group of students and to interpret their experiences in light of the existing literature in this area. While this study does not produce a list of best practices or suggestions for instructional strategies, it does present a number of issues and concerns voiced from the students' perspective. The value in this study comes from the increased awareness of the factors that contribute to this type of learning experience and the identification of the change in the students' perception of the significance of these factors. The reactions of these students may not be replicated in similar studies but this study has identified a few areas that should be examined in future studies, especially the development of local peer support structures in videoconference courses, the degree to which adult characteristics can be transferred to younger learners, and the shift in the perception of the significance of the technology in the learning environment.

The Math 31 course was selected for this study because it was the type of course that traditionally experiences low enrolments in smaller schools and is a prime candidate for videoconference delivery. The nature of the course content and the length of delivery may be factors that contribute to the results obtained. The reader should be cautioned against making comparisons with videoconference courses in other subject areas, of shorter or longer durations, or videoconference events that can be labelled as course enhancement activities. The students in this study were observed during a five-month term and interviewed four times over that time period. In addition to identifying the concerns of the students, the intention was to identify changes in the students' perception of those concerns and their adaptation to the changing environment. Observational and interview data were collected, transcribed, and returned to the participants for review.

The data collected were examined from the perspective of change in the perceptions of each individual student and from the perspective of four, student identified areas of concern. The students in this study worked hard to master not only the course content but also the use of the technology and to develop a support structure needed for success. In so doing, they identified issues related to the use of the technology, the pedagogy, the social and personal characteristics, as well as the

context of the learning experience. The comments from the students in this study indicate that the learning experience is a mixture of these contributing factors and that their perceptions of these factors changed over the duration of the course.

The most identifiable difference between this course and others these students had taken was the use of the technology. In some cases it was the primary drawing feature of the course while in others it was perceived immediately as a barrier. The failure to provide training to the students in the use of the technology added to the initial frustration experienced by the students and, in some cases, was a major reason for dropping the course. The significance of the technology, in the minds of the students, diminished rather quickly. As the students mastered the operation of the videoconference equipment their attention shifted to the quality of the instruction. The characteristics of the technology did not disappear but were rephrased in terms of how it was used to deliver instruction. The technology itself did not change over the duration of the course but the students' perception of it did. The establishment of a routine in the use of the technology may result in an increased level of comfort and a sense of empowerment but may also blind the users to alternative uses or communication avenues. Initial student training in the use of the videoconference technology coupled with discussions focused on the learning in this environment may be beneficial.

The students in this study had concerns about the way in which this course was being taught from the beginning. Learning routines established by previous math instruction were being challenged and the rate of adaptation varied from student to student. This factor, probably more than any other, contributed to the level of satisfaction of the students and was expressed as the major reason for dropping the course. The interesting observation related to this satisfaction was that the students were reluctant to express their concerns to the teacher. Cindy commented that if the teacher were present she would have made the comment in a one-on-one conversation that they would prefer to have some time to work on the assigned problems rather than being lectured for the full class period. This, however, was not something she was willing to do in front of the entire class for fear of embarrassing the teacher and labelling herself as a difficult student. This reluctance may warrant considering a formative communication structure between the students and the instructor that provides an opportunity for constructive feedback while maintaining the anonymity of the students. This apparent lack of communication reinforces the need, on the part of the teacher, to check for understanding. In a face-to-face setting this may be accomplished in a variety of ways but in a videoconference setting this must be planned and done in a very public manner. Looking over the shoulder of the students at the remote site is not an option but the

information regularly gathered in this fashion is still required. A method for obtaining information on individual student strengths and weaknesses as well as preferred learning styles in this mediated setting is an area worthy of further study.

The students concerns regarding the use of the technology and the teaching style of the instructor draws attention to the need not only to provide technical training to both the students and the instructor but also the need to prepare the students for the mediated environment, as Brown (2001) suggests, by having them examine how they learn. Videoconference teachers must also be aware of the cues they use to drive their instruction and the avenues used to gather information from and about their students. Learning styles are varied and an understanding of their differences is critical in providing instruction to individual learners. Palloff & Pratt (1999) indicate that developing methods of gathering this information is central to promoting a comfortable learning environment.

Two aspects of the social nature of the learning experience came to light in this study. The remote site visits by the teacher were critical in establishing a bond between the teacher and the students. The students indicated that being seen and heard in a virtual setting is not the same as being present. The students at the remote site did not feel

that they could get to 'know' the teacher through the videoconference medium. They looked forward to the time when she would visit their class so that they could get to know her and she could be able to understand them a little better. An interesting observation was that the students did not feel able to initiate the type of interaction required to get to know the teacher through the videoconference link. After the first remote site visit the students indicated that they had a better understanding of the teacher's personality, her sense of humour, and felt more at ease in engaging her in conversation. They also felt that she had a better understanding of their unique strengths and weaknesses and knew what to expect from each of them. All of this information was gleaned from teaching a single, one-hour class from the remote site. From this observation we have recommended monthly remote site visits by our videoconference teachers and have encouraged the teachers to meet with the students before the course begins.

The second social component that emerged from the observations was the development of a support community by the students at the remote site. The students who had been friends before the course began indicated that their friendship strengthened over the duration of the course while the students that did not belong to that circle of friends did not complete the course. Two of the three students that dropped the course indicated that they usually relied on classmates for assistance in

other classes but did not have any friends in this class. On days when I made site visits, these students were more than willing to ask me for assistance but did not ask their fellow classmates. Students indicated that there are questions that they felt comfortable asking in front of the entire class while there are other types of questions that would normally be addressed in a one-on-one conversation with the teacher. One-on-one conversations were not possible in this setting. Those that had friends they could direct those 'small' or 'minor' questions to seemed to fare better that those that did not. A more active approach to checking for understanding on the part of the instructor may assist in this area. Hung, Dennis, & Robert (2004) suggest that activities aimed at building a higher level of trust between the students and the instructor may have helped in retaining these students. The area of trust development and strategies to encourage student engagement at the secondary level is worth further examination.

This videoconference course was a small segment of the daily activities of the students involved. The setting or context in which it took place had a great deal to do with the students' perceptions of the experience. The history that each student brought to the setting formed a standard against which this course was judged as well as expectations related to the role of the instructor. As the course progressed, the students adapted to the setting and the instruction. In so doing, they

created their own history related to this videoconference course. As Mark had indicated, the videoconference room had become a place where "good things happen". The remaining students displayed an ownership of the space, a comfort level associated with working in that space, and a level of knowledge and control over the technology. The three students that completed the course indicated that the development of that relaxed atmosphere and feeling of belonging associated with the videoconference room was something that took time to establish and could not be rushed. Examining the factors that contribute to the establishment of videoconference settings as places where students can engage in the construction of understanding is worth exploring.

The purpose of this study was to examine the experiences of high school students taking a course by videoconference. The concerns and issues raised by the students in this study have led to changes that occurred throughout this course and in subsequent courses. A number of these have been noted throughout this dissertation. In addition, it has led to ongoing discussions with those teachers involved in this mode of course delivery and has led to a number of other potential research questions. This study was conducted with a point-to-point instructional setting with students at the host site with the teacher. Student comments indicate that there may be more interaction between the students at various sites if the instructor did not have students at the

host site. Does the presence of students at the teaching site present a barrier to interaction among students? Do the different possible videoconference configurations with respect to the locations of students and the instructor create different pedagogical demands on the instructor?

The course used in this study was not a required course. Would the dynamics of the situation be different if it were a course required for graduation? Also, the content of this course could be labelled as factual in nature and the instruction focused on the transfer of information. How would the experiences differ with a course that required more discussion and building consensus? Videoconference technology is not only used in secondary schools for course delivery but also for program enhancement. Do different pedagogical issues arise in these settings as compared to those that surface during conventional course delivery?

By the end of this study, the three students indicated that the strong support group that had formed at that site was the only reason that they continued and succeeded in the course. How would the experience of a single student at one location differ from that of this group? What support structures would develop in this setting? The three students that completed this course indicated that the development

of the strong support group was built upon an existing friendship. Are there ways of developing this type of support structure among students where this prior friendship does not exist?

Each of the students entered the videoconference course with a background built up over twelve or thirteen years of public school experience. The videoconference course is now also a part of the students' background. Will this experience influence or change the way in which they approach future learning activities and shape the support structures they build around themselves? If so, in what way? A longitudinal study of learning strategies employed by students taking courses in this format would be worthwhile in providing answers to these questions.

Finally, the school jurisdiction in which this study took place is using videoconference delivery, not only at the high school level, but for students as early as grade three. What pedagogical issues arise at this level that differ from those at the high school and how do these elementary students view their videoconference experience?

I hope that the findings of this study are not viewed as answers to questions but as stimulants for further discussion and research. The uniqueness of the characteristics of this case preclude the ability to

generalize but do bring up areas that we as practitioners in mediated instruction should be aware of. Discussions with the participants in this study have reinforced in my mind the fact that learning is a human, rather than a technical, activity and, as such, we need to be constantly aware of differing interpretations and perceptions of events. Rather than forcing closure on this study by suggesting a list of best practices, I would hope that readers would take from this study the sense of the importance of talking with students, reflecting on their practice, and a willingness to be receptive to change while, at the same time, retaining a focus on what is best for the learner.

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